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A TAXONOMIC STUDY OF SOUTHERN AFRICAN HYPHOMYCETES

BY

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CONTENTS

CONTENTS	1
INTRODUCTION	4
A HISTORICAL REVIEW OF THE DEVELOPMENT OF THE TAXONOMY OF MITOSPORIC FUNGI, IN PARTICULAR THAT OF THE HYPHOMYCETES.....	8
Introduction	8
Early taxonomy	9
Structure-function relationships and functional diversity	12
Recent developments.....	17
Current dilemmas	18
Recent contributions to Hyphomycete taxonomy	22
STUDY AREAS AND METHODS.....	24
Sampling sites.....	24
Methodology.....	25
TAXONOMIC PART.....	27
<i>Acrodictys deightonii</i> M. B. Ellis.	28
<i>Acrodictys globulosa</i> (Tóth) M. B. Ellis.....	29
<i>Acrogenospora sphaerocephala</i> (Berk. & Br.) M. B. Ellis.....	30
<i>Actinocladium rhodosporum</i> Ehrenb.....	31
<i>Alternaria alternata</i> (Fr.) Keissler.....	32
<i>Alysidiopsis pipsissewae</i> Sutton.....	33
<i>Balanium stygium</i> Wallroth.	35
<i>Bispora betulina</i> (Corda) Hughes.....	36
<i>Brachydesmiella biseptata</i> Arnaud ex Hughes.....	37
<i>Brachysporiella gayana</i> Batista.....	38
<i>Brachysporium bloxami</i> (Cooke) Sacc.	40
<i>Camposporium antennatum</i> Harkness.....	41
<i>Catenularia</i> anam. state of <i>Chaetosphaeria innumera</i> Tul.	42
<i>Chalara aurea</i> (Corda) Hughes.	43
<i>Chalara hughesii</i> Nag Raj & Kendrick.....	44
<i>Chalara inflatipes</i> (Preuss) Sacc..	45
<i>Chloridium clavaeforme</i> (Preuss) Gams & Hol.-Jech.....	46



<i>Chloridium smithii</i> Sinclair & Eicker.	47
<i>Chloridium transvaalense</i> Morgan-Jones, Sinclair & Eicker.	48
<i>Coniosporium</i> anam. state of <i>Hysterium insidens</i> Schw.	49
<i>Cylindrotrichum probosciophorum</i> (DiCosmo, Berch & Kendrick) Arambarri & Cabello	50
<i>Dendryphiopsis</i> anam. state of <i>Amphisphaeria incrustans</i> Ellis & Everh.....	52
<i>Dicranidium fragile</i> Harkness.	53
<i>Dictyochoeta</i> anam. state of <i>Chaetosphaeria pulchriseta</i> Hughes, Kendrick & Shoemaker.	54
<i>Dictyosporium heptasporum</i> (Garov.) Damon.....	55
<i>Diplocladiella scalaroides</i> Arnaud apud M. B. Ellis.	56
<i>Diplococcium</i> anam. state of <i>Helminthosphaeria clavariarum</i> (Tul.) Fuckel.	57
<i>Diplococcium spicatum</i> Grove.	58
<i>Endophragmia biseptata</i> M. B. Ellis.....	59
<i>Endophragmia uniseptata</i> M. B. Ellis.	60
<i>Endophragmiella lignicola</i> Hughes	61
<i>Engyodontium parvisporum</i> (Petch) de Hoog.	62
<i>Haplographium</i> anam. state of <i>Hyaloscypha dematiicola</i> (Berk. & Br.) Nannf.....	63
<i>Helicoma dennisii</i> M. B. Ellis.	64
<i>Helicosporium</i> anam. state of <i>Tubeufia helicomyces</i> Höhnel.....	65
<i>Henicospora minor</i> Kirk & Sutton.....	66
<i>Heteroconium solaninum</i> (Sacc. & Syd.) M. B. Ellis.	67
<i>Monodictys capensis</i> Sinclair, Boshoff & Eicker.....	67
<i>Monodictys gemmipara</i> Rao & de Hoog.....	72
<i>Nodulisporium radians</i> (Berk.) Deighton.	73
<i>Oidiodendron griseum</i> Robak, apud Melin & Nannf.....	74
<i>Phaeoisaria clematidis</i> Hughes.	75
<i>Pleurothecium recurvatum</i> (Morgan) Höhnel.	76
<i>Pseudospiropes simplex</i> (Kunze ex Pers.) M. B. Ellis.	77
<i>Rhinocladiella</i> anam. state of <i>Dictyotrichiella mansonii</i> Schol-Schwarz.	77
<i>Rhinocladium pulchrum</i> Hughes & Hol.-Jech..	78
<i>Riessia semiophora</i> Fresenius.	79
<i>Selenosporella curvispora</i> MacGarvie.	80
<i>Spadicoides obovata</i> (Cooke & Ellis) Hughes.....	81



<i>Sporoschisma nigroseptatum</i> Rao & Rao.....	82
<i>Stachybotrys chartarum</i> (Ehrenb. ex Link) Hughes.....	83
<i>Stachybotrys kampalensis</i> Hansford.	83
<i>Symptodioplanus capensis</i> R. C Sinclair et Boshoff.....	85
<i>Taeniolella scripta</i> (Karst.) Hughes.....	92
<i>Tetracoccosporium paxianum</i> Szabó.....	93
<i>Ulocladium tuberculatum</i> Simmons.	94
<i>Veronaea indica</i> (Subram.) M. B. Ellis.....	95
<i>Virgariella atra</i> Hughes.....	95
<i>Virgariella sphaerica</i> Matsushima.	96
DISCUSSION.....	98
CONCLUSION	101
SUMMARY.....	102
OPSOMMING.....	104
ACKNOWLEDGEMENTS.....	106
PHOTOGRAPHIC PLATES.....	107
Plate 1	107
Plate 2	109
Plate 3	111
Plate 4	113
Plate 5	115
Plate 6	117
Plate 7	119
Plate 8	121
Plate 9	123
Plate 10	125
Plate 11	127
Plate 12	129
Plate 13	131
Plate 14	133
Plate 15	135
REFERENCES	137

INTRODUCTION

The object and scope of this research has been to -

- contribute to a better understanding of the taxonomy of the Hyphomycetes through a comprehensive study of the available literature; and
- increase the data on Hyphomycetes in southern Africa.

Hyphomycete classification

Fungi are capable of reproducing both sexually and asexually. The phase associated with production of asexual spores is known as the asexual or imperfect state or the anamorph or mitosporic phase. The formation of spores resulting from a sexual process is called the sexual or perfect state or the teleomorph or meiosporic phase. Tulasne and Tulasne (1861 - 1865) first recognised fungal pleomorphism; that is, they can produce different fructifications in their life cycles. They described the association of perfect (teleomorph) and imperfect (anamorph) phases. Fuckel (1870) was the first to publish the recognition of asexual phases in a separate group - the Fungi Imperfecti. The latest term introduced for this miscellaneous assemblage of microscopic fungi which are asexually reproducing is mitosporic fungi (Hawksworth *et al.* 1995). Their relationship to a sexually reproducing fungus is frequently unknown and in some, sexuality has been lost. Broadly defined, they are conidium-forming fungi, where spores are formed without fusion of nuclei or meiosis. They include any and all sexual expressions of true fungi (Ascomycetes and Basidiomycetes). They may occur separately in time and/or space from their respective sexual phases and may have evolved as discrete entities so as to preclude determination of biological relatedness.

The International Code of Botanical Nomenclature sanctions the use of the different names for the different states of a pleomorphic fungus, but rules that the name of the holomorph (that is the whole fungus in all its states, which may include a teleomorph and one or several anamorphs, or anamorphs only), is to be that used for the teleomorph (sexual state) (Hawksworth *et al.* 1983).

Two major anamorph groups or classes are currently distinguished within the mitosporic fungi on the basis of differences in their sporulating structures namely, the Hyphomycetes and the Coelomycetes. Hyphomycetes form their conidia on or from conidiophores that may be single or aggregated into synnemata or sporodochia but never develop under the shelter of any protective integument. Coelomycetes develop their conidia beneath some kind of protective integument and the conidiomata are called pycnidia and acervuli.

The Hyphomycetes are important in that they occur abundantly in natural and man-made ecosystems. Their role in these ecosystems is one of great diversity. They occur on all kinds of substrates in a variety of habitats and occupy a multitude of unique niches. There are species which are pathogens of plants and animals and species that cause spoilage of food and deterioration of both natural and man-made materials. The exploitation of these biological capabilities has resulted in the use of many species in various industrial processes such as fermentation and pharmaceutical production (Ellis 1971).

Morphological characteristics form the historical basis of Hyphomycete taxonomy, which has been an arrangement of convenience. Broad morphological similarities have been used to form divisions. The Dematiaceae are a group of Hyphomycetes which have pigmented hyphae and/or pigmented conidiophores and/or pigmented conidia. Other Hyphomycete groups are the Moniliaceae, which have hyaline conidiophores and conidia; the Stilbellaceae, where the conidiophores are aggregated as synnemata; the Tuberculariaceae, where the conidiophores are aggregated on sporodochial conidiomata and the Mycelia Sterilia.

Records of Hyphomycete collections in South Africa

Mycologists have been collecting within South Africa from a wide range of habitats for over two hundred years. Doidge (1950) recorded the early history of South African mycology in her monumental catalogue *South African Fungi and Lichens to the end of 1945*. To supplement this, Gorter (1979) compiled a bibliography of South African mycological publications for the period 1946 to 1977. Since Gorter's bibliography, work done by local mycologists has largely not been documented.

In-depth work that has been done in recording Hyphomycetes is listed here according to the habitats investigated:

- . mushroom compost: Eicker 1977;
- . dung: Roux 1996;
- . dead wood and leaf litter collected in indigenous forest habitats: Eicker 1973; Morgan-Jones 1982b; Morgan-Jones & Sinclair 1980; Morgan-Jones *et al.* 1983, 1987a, 1987b, 1991, 1992; Partridge *et al.* 1999; Sinclair 1990; Sinclair & Eicker 1985, 1987; Sinclair *et al.* 1983b, 1986, 1987, 1990, 1996, 1997;
- . aquatic habitats: De Kock 1993; Ferreira *et al.* 1981; Greathead 1961; Sinclair & Eicker 1981, 1983, 1987; Sinclair *et al.* 1983a; Van der Merwe & Jooste 1988; Webster *et al.* 1994, 1995;
- . graminicolous microfungi: Jooste 1975, 1976; Eicker 1976b; Papendorf & Jooste 1974a, 1974b; Robbertse *et al.* 1995;
- . foliicolous microfungi and pathogens occurring on woody hosts: Crous 1993; Crous & Braun 1994, 1995, 1996a, 1996b; Crous & Kendrick 1994; Crous & Peerally 1996; Crous & Sutton 1997; Crous & van der Linde 1993; Crous & Wingfield 1991, 1992, 1993, 1996; Crous *et al.* 1989a, 1989b, 1989c, 1989d, 1990, 1991, 1992, 1994, 1995a, 1995b, 1996, 1997; Morris & Crous 1994; Smith *et al.* 1996; Van der Westhuizen & Holtzhausen 1980; Wingfield *et al.* 1988;
- . soil: Eicker 1969, 1970a, 1970b, 1974, 1975, 1976a;
- . miscellaneous habitats: Rong & Botha 1993.

New records and associated descriptions have also been published by researchers studying plant, animal and human pathogens such as W. F. O. Marasas, an internationally renowned expert on *Fusarium* and mycotoxins, and H. F. Vismer, an expert on human pathogens and dermatophytes. However, their work concentrates on the physiological behaviour of these fungi as an identifying feature thereof and is therefore not dealt with.

Thus, a unique diversity has already been recorded from various habitats in southern Africa.

To contribute to the latest taxonomic data on Hyphomycetes in the region this research has recorded the occurrence of these fungi on dead plant material, mostly wood, from forest habitats in three provinces of South Africa.

A HISTORICAL REVIEW OF THE DEVELOPMENT OF THE TAXONOMY OF MITOSPORIC FUNGI, IN PARTICULAR THAT OF THE HYPHOMYCETES

Introduction

Taxonomy of the mitosporic fungi is currently in a state of controversy. Even the terminology used for the group itself is a source of dispute. The name Fungi Imperfecti came to disrepute because it was considered a “degrading” and misleading term. Certain researchers have hailed some of these fungi as more developed than sexual fungi as they can facilitate gene exchange through the parasexual state. They are defined as asexually propagating fungi, whether they lack capacity for sexual propagation altogether or whether they can be associated with a particular teleomorph, at least occasionally. Carmichael *et al.* (1980) hold that the term anamorphic microfungi, introduced by Donk (1960), is not exclusive to the asexual phase of ascomycetous or basidiomycetous states, but can refer to the asexual stages of the Mastigomycotina and Zygomycotina and should therefore be appropriately qualified. The term holomorph, introduced by Hennebert & Weresub (1977) has been reserved for fungi with teleomorphic sporulation including all their sporulating or vegetative anamorphs (Gams 1995). Mitosporic fungi, which is the latest term introduced, has not been completely accepted since the terms anamorph and teleomorph are terms for the organs of reproduction rather than the karyological phases. Therefore, the use of the term “meiotic fungus” merely states that the fungus at some point in its life-cycle is known to undergo meiosis (Korf & Hennebert 1993; Gams 1995). The eighth edition of *Ainsworth & Bisby's Dictionary of the Fungi* (Hawksworth *et al.* 1995) promotes the terms *Mitosporic fungi* and *mitosporomata* instead of Deuteromycetes and conidiomata. This review will use the terms Hyphomycetes, conidial fungi, anamorphic microfungi and mitosporic fungi interchangeably for this group of fungal organisms.

Early taxonomy

Until the advent of light microscopy, anamorphic microfungi were virtually unknown. In the early sixteenth centuries, the microscopic morphology of these organisms became the means of study and classification. Emphasis on various features used to distinguish them has changed or taken precedence over others as time and knowledge have progressed.

Subramanian (1971) gave Micheli credit as the first biologist to give generic names to certain fungi which are now still classified in the Hyphomycetes. The classification system that he used in *Nova Plantarum Genera* (Micheli 1729) was morphology based, using the conidium shape and size and the way it is borne as distinguishing characteristics.

Then, for nearly a century, little occurred in the development of taxonomic theory of the Hyphomycetes, but descriptive contributions were made by many authors such as Tode during 1790 - 1791 in his series *Fungi Mecklenburgenses selecti*, Link (1809, 1815, 1824 - 1825, 1833), C. G. D. Nees von Esenbeck (1817), C. G. D. & T. F. L. Nees von Esenbeck (1818), T. F. L. Nees von Esenbeck & Henry (1837), Kunze & Schmidt (1817 - 1823) and Ehrenberg (1818, 1819). Among them they established names, records and references for most of the common and important genera (Ainsworth 1976; Subramanian 1983; Hawksworth *et al.* 1995).

The first comprehensive work in which these diverse taxonomic works were brought together was the *Synopsis Methodica Fungorum* of Persoon (1801). His *Observationes Mycologicae* (1795 - 1799), *Synopsis Methodica Fungorum* (1801) and other papers were used as the framework on which Fries and later systematics workers based their classifications. Persoon treated a wide variety of fungi, not only the Hyphomycetes. He divided fungi into two main groups on the basis of whether their fructifications were open or closed. This failed as a primary differentiating characteristic, because fungi such as acervular Coelomycetes, some leaf and stem rusts (Ascomycetes) and some sporodochial Hyphomycetes with open fructifications would be grouped together (Kendrick 1981a), while they are biologically very diverse.

The work of Fries, *Systema Mycologicum* (1821 - 1832), has been chosen as the starting point work for nomenclature of conidial fungi. The three volumes of his *Systema* appeared serially between 1821 and 1832. The Hyphomycetes are dealt with in the second part of the third volume (1832), though mention of generic names of Hyphomycetes is also found in the first volume (1821). The first validly published name after this starting point has priority with respect to article 13f of the International Code for Botanical Nomenclature. Fries's treatment of Hyphomycetes was based on Persoon's, however, mainly because Fries had little use for a microscope (his *Systema* was produced without one), his own taxonomic judgements on Hyphomycetes were generally inaccurate (Subramanian 1983). Carmichael *et al.* (1980) defended Hughes's use of Persoon's *Synopsis Methodica Fungorum* as the starting point, stating that, when using Fries's works as a starting point, it was difficult or impossible to be sure of the proper citation and application of some names.

The dual modality of fungal propagation, sexual and asexual, has been known since the work of the Tulasne brothers (Gams 1995). They discovered that many Hyphomycetes and other imperfect fungi were the asexual states of the Ascomycetes and Basidiomycetes (Subramanian 1971). In their *Selecta Fungorum Carpologia* (1861 - 1865) they discussed the issue of pleomorphism in fungi. Their contribution opened up an altogether new line of thought and led later naturalists to regard all fungi of which the 'winter fruits' are unknown as 'imperfect'. This led to the establishment of the taxonomic group, Fungi Imperfecti, in 1870 by Fuckel. De Bary (1854) and Brefeld (1874) pioneered the use of pure culture techniques which became essential to the investigation of teleomorph connections and pleomorphy.

By the middle of the nineteenth century, many Hyphomycetes had been described. A synthesis of the descriptive works from which one could reference descriptions of all the known taxa, was needed again. Saccardo took up this work. Saccardo in *Sylloge Fungorum* (1886) not only provided this compilation, but also described a classification system which he based on the type of fructification a fungus produced. He used as primary differentiating characteristics structures such as pycnidia and acervuli which are now grouped together as Coelomycete structures. He also used conidiophore structure, conidium pigmentation and conidium morphology, which are important differentiating

features in Hyphomycete taxonomy today. Saccardo divided the Hyphomycetes into four families, namely Mucedinaceae/Moniliaceae characterised by hyaline or lightly pigmented conidia and conidiophores; Dematiaceae with conidia and conidiophores which are more or less darkly pigmented; Tuberculariaceae with short conidiophores borne on a sporodochium; and Stilbaceae with long conidiophores forming synnemata. Within these four groups, seven morphological spore types were described based on shape and septation, namely: amero-, dictyo-, didymo-, helico-, phragmo-, scoleco-, and staurospores. Costantin (1888) in *Les Mucédinés Simples* proposed a different approach to the classification of the Hyphomycetes, where the attachment of the conidia to the parent hyphae is of diagnostic importance. Ontogenetic characteristics were thus being explored for their significance.

Issues of genetic relationships remain in a measure of doubt when morphological features are empirically treated. Characteristics of biological significance were addressed in attempts to identify lines of relatedness more naturally. Vuillemin in *Les Conidiosporés* (1910) and *Les Aleuriosporés* (1911) proposed a system of classification of the Hyphomycetes based primarily on the biological process of conidium formation, in essence an ontogenetic approach to systematics. This created a reference point for the interrelationship of the morphological features occurring among the taxa.

Mason's recognition of the sympodially proliferating conidiogenous cell represented a real advance in 1933. He was influenced by Vuillemin's ideas on the modes of conidium ontogeny. He reworked Vuillemin's definition of the phialide and proposed different terms for the structures found, namely: meristem spores - a term for the phialospores of Vuillemin, since the tip of the phialide is practically an open growing point; terminus spores - for those that develop at the tip of the phialide singly without successive development of spores from the same phialide; and the radula spores - spores borne on "little pegs" or denticles. In 1937 he proposed a biological spore type in an attempt to group the Hyphomycetes more on their biological capabilities. He suggested that spores of the Fungi Imperfecti are of only two types - dry and slimy - the former being usually disseminated by wind and the latter by insects or water. Kendrick (1981a) disagreed, stating that these characteristics are ecologically imposed and evolved independently.

Barron (1968) cited the work of Zuck (1946) and Smith (1962) in support of his theory that this classification system cuts across many natural relationships of known taxa and their affinities and that species of a genus or even strains of a species may show both dry and wet spored forms. Subramanian (1971) noted that several Hyphomycete species produce more than one morphological or biological spore type. Ingold (1942) described the aquatic spore type where a relationship is drawn according to the physical environment the species has evolved in. Confounding implications are made when many species are found on substrates well away from water (Hudson 1986).

Nonetheless, the importance of recognising the habitat of the fungus remains. All authors cite substrate, habitat and location when noting records. Substrate and ecological preference appear to confer a marked taxonomic distinction. It frequently indicates significant differences in the taxa when isolated from different substrates. For example, the genus *Spiropes* Ciferri is parasitic although morphologically similar to the saprotrophic *Pseudospiropes* Ellis. Although the geographical location is always recorded with a collection, the ubiquity of these organisms has yet to enable taxonomists to infer relatedness based on geographical distribution.

Structure-function relationships and functional diversity

Superficial morphological resemblance was once awarded more value in classification than the individuality and the origin of processes such as the development of structures. Morton (1990) stressed that the decisive factors in evolution may not be reflected in morphology, but may be reflected in physiological processes. He encouraged studies to assess the correlation between molecular and morphological divergence to provide information on the relatedness between physiological factors and conidium development. Morton (1995) theorised that developmentally defined morphological characters provide causal linkages between taxonomic hierarchy and the hierarchy of conidium sub-cellular structure evolution, thus a suggested causal relationship between form and function. However, Franke & Morton (1994) quoted Lauder (1981) who stated that “it is only through rigorous tests to hypothesise homology that morphological characters are

trustworthy enough to define phylogenetic relationships and subsequently relate pattern to process” or more aptly, process to form and form to function.

Fungi are heterotrophs and therefore obtain food supplies by absorption. In order to grow, they require sources of carbon and nitrogen, a supply of energy and certain essential nutrients such as potassium and phosphorus (Dix and Webster 1995). As far as nutritional relationships are concerned, fungi may be saprotrophic - deriving nutrients from dead organic matter, necrotrophic - deriving nutrients from dead cells which the organism has killed itself, or biotrophic - deriving nutrients from living cells (Cooke 1979). Growth form in the fungi reflects their absorptive, sessile lifestyle. Aggregation or differentiation of a few basic cell types gives rise to multicellular complexes associated with foraging, reproduction, survival or dispersal activities (Andrews 1995).

Hyphomycetes are the most common fungal manifestations of all (Cole and Kendrick 1981). Hyphomycetes are highly advanced and are genetically extremely well equipped for morphological variation. Niches are occupied quickly and effectively as a result of a multitude of adaptations. Morphological characters used to indicate relationships are becoming less effective in this group. Any work on Hyphomycetes requires the recognition of the sporulating structures, however, Hyphomycetes exhibit such a high level of plasticity and physiological versatility that an enormous range of diverse morphological structures occurs.

The growth and activity of Hyphomycetes are a response to physical, chemical and biological factors in the environment (Subramanian 1983). Thus, specific habitat factors induce or influence the huge array of morphologies that is exhibited by the Hyphomycetes and therefore play a role in determining relationships between the taxa. These functional similarities within the fungi therefore restrict our ability to determine genetic relationships. Determining the array of responses, how that diversity in response arose and what role it plays in the development and functioning of the ecosystem become the critical questions.

Dix and Webster (1995) also agree that the form and structure of a fungus spore has a considerable influence on the ecology of the fungus; that is its substratum, habitat and

vector and that variation in size and shape of conidia correlate with habitat and mode of dispersal. Booth (1978) went so far as to suggest that the similarities in structure of certain fructifications of conidial fungi were more dependent on their location in the environment than on their genealogical relationships. While the importance of environmental factors has been long recognised, relatively little factual information is available.

Physical factors that influence morphological characteristics which have received study include moisture, temperature, light, and substratum related factors such as pH and aeration. Drechsler (1923) postulated that the *Alternaria*-like short conidial chains formed by *Helminthosporium catenarium* are facilitated by moisture. One effect of increasing water stress found by Harrower and Nagy (1979) was to be that the time taken for fruiting was reduced, possibly to ensure rapid production resulting in dispersal and survival. Crowe *et al.* (1984) found that fungi which inhabit dry environments have spores that are adapted to withstand desiccation owing to protection afforded to membranes by trehalose. Temperature affects different phases of the life cycle of a fungus: germination, mycelia growth and sporulation (Koske and Duncan 1974). The response of Hyphomycetes to temperature varies between the two extremes of obligatory thermophilia through thermotolerant to psychrophilia (Subramanian 1983). The many ways in which light influences growth and sporulation of Hyphomycetes have been well reviewed (Subramanian 1983). Some effects are the induction of conidiation, melanogenesis, *et cetera*. Light, as one of the aspects of the physical environment of fungi, has also been reviewed by Page (1965). Pigmentation, morphological and morphogenetic effects of visible and ultraviolet light on fungi are discussed by Leach (1971) in a practical guide to the effects of light on fungi.

Morphological characteristics influenced by physical factors in the natural environment include pigmentation, definitive size and shape of conidia, spore wall thickness, spore wall ornamentation, dryness or sliminess of the outer spore surfaces and conidiophore aggregation. Great stress is placed on the pigmentation of conidia and conidiophores - dematiaceous Hyphomycetes are recognised on this basis. However, pigmentation in a fungus may be influenced by a number of physical factors in the natural environment.

Durrell and Shields (1960) and Hunt and Durrell (1966) recovered a number of fungi from the Nevada atomic bomb test site and from soils from the Death Valley National Monument, California. It was noted that the larger number of species had spores incorporating melanin pigments in the walls. It was then suggested that melanin may serve a protective function to ultraviolet light. Other evidence that the deposition of melanin in spore and hyphal walls enhances survival was provided by Old and Robertson (1970). Enhanced survival of pigmented fungal structures is apparently due to a greater resistance to lysis produced by the formation of a chitin-melanin complex in the walls (Bull 1970). Pugh and Buckley (1971) found that the pigmented spores of, for example, *Epicoccum* spp. survived exposure better than the hyaline spores of *Aureobasidium pullulans*. An intensive study of one species of *Coccosporium* (Higinbotham and Powers 1947) presents a review of pigment formation and shows that temperature, aeration, pH and carbon source are important factors in the development of the red pigment in that species.

Spore size determines the mechanism of spore dispersal. The upper and lower limits on spore size are probably set by physical constraints; the upper by a mechanical limitation on the maximum weight that can be supported on a stalked structure and the lower by the minimum volume sufficient to enclose the necessary cell machinery plus energy reserves (Andrews 1995).

Most of the morphological features of the conidium, such as surface structure and definitive shape, become differentiated later by phenomena characterising the stage of conidium maturation (Mangenot & Reisinger 1974). Webster (1987) stated that the distinctively shaped Ingoldian Hyphomycetes are not a group of closely related organisms, but represent fungi which have become morphologically and physiologically adapted to aquatic habitats.

Increasing spore wall thickness is one of the numerous ways in which the conidial habit may improve an organism's fitness in a given environment. The formation of chlamydo-spores or thick-walled spores can allow a fungus to survive without migration until favourable patches of resources become available for colonisation.

Spore wall ornamentation is one of the features of the spore which is apparently most stable. Dufour (1888) studied the morphological variations of *Trichocladium asperum* and demonstrated the absence of ornamentation when conidia were grown in some liquid media. It is suggested by Mangenot and Reisinger (1974) that the appearance of ornamentation depends on the genetic constitution of the species, but the morphological expression of this ornamentation is closely dependent on hygrometric conditions which allow the formation of the external film. This film may represent a small quantity of mucilaginous products excreted during the conidial maturation and subsequently condensed by rapid dehydration. Dryness or sliminess of outer spore surfaces is a very important characteristic in the analysis of propagule dispersal. Sliminess may give protection from ultraviolet radiation, reduce water loss and assist in rehydration (Dix and Webster 1995).

Conidiophore aggregation, the taxonomic significance of synnemata is a difficult problem in the classification of the Hyphomycetes (Barron 1968). Hyaline forms seem to be protected by aggregation and thus have a better survival rate when exposed than their individual cells or spores. Conidiophore aggregations into sporodochia and synnemata are much more typical of terrestrial species and may also be adaptations to drier habitats. Their formation is significantly affected by environmental conditions such as temperature (Wolfe 1976). Synnemata formation in *Ceratocystis ulmi* is affected by the modification of the nutritional constituents of a defined agar medium. More synnemata are produced on the medium containing glucose (Bays and Hindal 1982). Katz *et al.* (1972) proposed that the pattern of branching may well be determined by both the tendency of the fungus to grow exponentially and by the effect of environmental conditions.

It would therefore be necessary to emphasise that in conidial fungi the efficient production of propagules in large numbers and the efficiency of dispersal allow the establishment of "mutants" in favourable ecological conditions; thus, morphological evolution could in most cases have masked biological relationships.

New discoveries are being made in countries and habitats previously insufficiently explored, resulting in the recognition both of numerous new taxa (Bellemère *et al.* 1994), and of new systematic problems where intermediates and other variants in what were thought to be clear-cut characters have come to light (Hawksworth & Mouchacca 1994).

In resolving the issue of pleomorphism and relatedness, one needs to determine how easily the phenotype being described is modified (sexual recombination gives a teleomorph with several morphologically different asexual forms - that is, synanamorphs). In response to environmental signals, differentiation in anamorphic fungi varies in timing, extent and mode, interconverting growth forms and even decoupling the asexual and sexual phases of the life-cycle (Andrews 1995). However, Kendrick and Murase (1994) stated that anamorph genera which share rare or unusual characteristics may indicate monophyletic holomorphic groups. Therefore, the capacity for expression of characters and the relative ease with which characters change (i.e. what factors influence change), need to be considered. This would lead to a more accurate assessment of relatedness and the identifications of consistent characters that are meaningful and perhaps useful in practical applications of fungus identification.

Recent developments

Hughes (1953) concluded that the precise nature of conidiogenesis is the most important differentiating characteristic. He presented a system with eight sections using terms such as blastoconidia, annelloconidia, phialoconidia and tretoconidia. This system is the most influential work that has guided taxonomic theory until the present day.

Tubaki (1958) suggested some modifications to Hughes's scheme by subdividing the heterogeneous sections into subsections in a numerical system and by adding another section. He replaced his numerical system in 1963 with a more usable system in which he divided the Hyphomycetes into six major groups named after the type of spore produced, namely blastospores, radulaspores, aleuriospores, phialospores, porospores and arthrospores. Neither Hughes nor Tubaki gave any keys to the different sections to facilitate their usage. The schemes discussed were based on the differences in conidium

origin and also conidium development. Subramanian (1962), utilising the schemes of Hughes and Tubaki, proposed a system in which conidium origin and development again formed the taxonomic basis where six families are recognised based on conidium types that are the result of specific ontogenetic sequences. As one can see, the conidium again (*vide* Saccardo) became the focus by means of which taxonomists interpreted the applications of Hughes's system. Barron (1968) also presented divisions based on the morphological types of conidia which included several of Subramanian's subdivisions of the families. Hughes, Subramanian, Tubaki and Barron all created lines of distinction without recognising the phylogenetic significance thereof. Cole and Samson (1979) provided a pictorial guide using time-lapse photomicrography and transmission electron microscopy to record the broad range of characteristics of conidium ontogeny effectively.

Attempts were made to interpose accepted theories of relatedness with manageable methods of identifying fungi. An important conference was held, entitled "The First International Specialists' Workshop Conference on Criteria and Terminology in the Classification of Fungi Imperfecti" at the Environmental Sciences Centre of the University of Calgary, Kananaskis, where Kendrick (1971) stated: "The Kananaskis Conference has surely set a world-wide seal of approval on the ontogenetic approach to the systematics of the Fungi Imperfecti".

The Second International Mycological Conference was also held at the Environmental Sciences Centre of the University of Calgary, Kananaskis and the proceedings "The Whole Fungus" defined the aim to "use all of the data available in the elaboration and refinement of our classificatory schemes" (Kendrick 1979).

Current dilemmas

The prevalence of pleomorphism continues to plague taxonomists. Kendrick (1978) acknowledged that ontogeny is plastic and often not the conservative and reliable characteristic hoped for. Booth (1978) pointed out that the evidence for a particular intergeneric hiatus may be drawn from too few collections. A taxon may be described as having conidia of a certain type, while another similar taxon, has the same type of

conidium, but differ in septation. Meanwhile the intermediate taxa have not yet been collected, and the two taxa are then assigned to different genera which will only later be recognised as redundant when intermediate taxa are collected (Kendrick 1981b). Kendrick (1980) warned against the dangers of ignoring convergent evolution and stated that possible polyphyly cannot be used to “defend many of the segregated genera produced”. Unless the genetic significance of morphological characteristics can be ascertained, a veritable continuum of forms may be designed with no way of making distinctions.

Madelin (1979) advanced a confounding and plausible explanation for the transmutation of one form of conidiogenesis into another by a combination of environmental and temporal factors. He demonstrated that the factor determining whether development is holoblastic or enteroblastic in at least some cases is purely “the juvenility or maturity of the wall at the conidiogenous locus”. He proposed that, while reproductive structures are young and environmental conditions are favourable, contributions of cell wall material are unrestricted, but as structures mature and wall layers thicken, other modes of conidiogenesis must develop to carry on with reproduction. Thus, comparatively small changes in the behaviour of conidium-delimiting septa lead to fundamental alterations and result in very diverse modes of conidium production.

The ways in which conidiogenous cells and conidia develop then replaced the long accepted characteristics of conidial shape, septation and pigmentation as taxonomic criteria of primary importance. Holoblastic, enteroblastic and thallic were the three major modes of development recognised by, amongst others, Cole and Samson (1979). Academic investigations have ensued in attempts to define the phylogenetic significance and the implications of relatedness of the different modes of development in Hyphomycetes.

Minter *et al.* (1982) supported Madelin’s postulation. They examined the physiological complexity of the conidium-forming process and the degree of differentiation needed to create these different types. They stated that the developmental features of conidiogenous cells and conidia are often described in such a confusing way owing to the lack of fundamental information on the processes involved and the inadequacy of the terminology itself which is available to describe the developmental processes. They therefore rejected

the old and simplistic categories such as thallic, blastic, annelidic and phialidic and proposed that conidium ontogeny should be separated from conidiogenous cell proliferation to account for the changes that occur as a result of varying temporal and environmental factors and the age of the fungus (growth stopping and beginning again). They proposed the distinction of five stages, namely regeneration, proliferation, ontogeny, delimitation and secession so that all potential variation would be included. They argued that a small alteration at one stage of conidial production could lead to a large divergence in the appearance of the mature conidium and conversely, conidia remarkably similar in appearance could be produced through very different developmental pathways (Minter *et al.* 1982; 1983a; 1983b).

In recognising the principles of multifunctionality and plasticity, the basis of the approach is the view that all conidiophores, conidiogenous cells and conidia are more or less modified vegetative hyphae and that such modifications can be very plastic. Therefore, the key to interpreting conidiogenesis lies in understanding how hyphae grow (Minter 1987). Van Wyk *et al.* (1988) supported this approach by showing that differences in the synchronisation of the five stages of conidial development could result in conidiogenous cells that appear different but represent identical types of conidial development.

Roux and van Warmelo (1990) and Roux *et al.* (1990, 1994, 1995) made use of electron microscopy to show the different developmental pathways of conidiomatal and conidial ontogeny in *Urohendersonia*, *Stilbella* and *Tiarosporrella* spp.

In order to effect increased precision in distinguishing morphological features and thus their value as systematic tools, Hennebert and Sutton (1994) redefined twenty unitary parameters of conidiogenesis which cover three of the five stages of development defined by Minter *et al.* (1982, 1983a; 1983b).

The number of teleomorph-anamorph connections recorded is still insufficient to provide a clear picture of genetic relatedness. With the advent of molecular approaches to fungal taxonomy, some mycologists have advocated abandoning the dual system of naming (Reynolds and Taylor 1991, 1992; Blackwell 1994; Taylor 1995). Their argument has

been that, irrespective of the presence of a sexual or an asexual stage, DNA sequences would reveal the true affinities of any fungus that comes to hand. During the Holomorph Conference (Reynolds and Taylor 1993), the question of whether the division of the Deuteromycotina should be abandoned altogether in view of its affinities to sexually reproducing fungi was answered with an unequivocal “no” (Gams 1995). Use of restriction enzymes of DNA fragments was identical in a study comparing old preserved mycelium and fresh material (Wingfield & Wingfield 1993). This encourages the use of DNA studies to verify the Hyphomycete relationships. However, an enormous amount of data needs to be amassed. There is also the question as to how molecular data should be weighted in comparison to morphological data. Another important aspect is the reproducibility of results between laboratories (Witthuhn *et al.* 1997). Seifert *et al.* (1995) examined and challenged the validity of reclassifying filamentous anamorphs solely on the basis of ribosomal DNA sequence. From the perspective of the scientific method, neither morphological nor sequence based molecular systematics are inherently superior. In fact, the utilitarian aspect of morphological systematics has a great advantage over sequence based molecular systematics. Furthermore, morphological studies are used for the identification of organisms and hence the validity of hypotheses and the reproducibility of the observations are tested every time someone tries to identify a fungus. Sequence based molecular systematics have cost, expertise and time constraints. Where, in applied mycology, biochemical profile takes significance in defining the organisms or strains of specific organisms such as toxin producers, economically important metabolite producers or pathogens, more advanced methods need to be utilised such as PCR, RFLP, ELISA and GLC.

More and more fungal systematists turn to cladistics in studying relationships between fungi (Tehler 1994). Groups or patterns that can be tested by molecular methods, are formed on the basis of morphological data sets. However, Hawksworth and Mouchacca (1994) warned that there are many pitfalls concerning interpretation when, in employing this technique, disagreement exists between supporters of computed consensus trees and the presentation of all parsimonious trees obtained.

Once enough data has been collected, it will provide gene segments that separate “morphologically” similar genera. If these can be related to specific morphological characteristics, the lack of these segments in “morphologically dissimilar” genera will support the usefulness of these characters for generic distinction.

Recent contributions to Hyphomycete taxonomy

Contributions to Hyphomycete taxonomy in the past thirty years have been substantial. The single most useful compilation using all published information is *The Genera of Hyphomycetes* (Carmichael *et al.* 1980). This provides an extensively annotated list of all the names proposed for Hyphomycete genera and their currently accepted status. Excellent line drawings contributed by G. Morgan-Jones, B. Peterman and O. Rose, show the characteristic morphology of one or more species from each genus. Key-lists assist in identification and the substrate and or host is reported. Any teleomorph associations are included.

Ellis (1971, 1976) has provided two excellent reference texts of well-illustrated descriptions of species in over 295 genera in standardised format. A key to the genera, based on conidiogenesis, a substrate index and a glossary of important terms are included.

Kendrick (1990) and Wolfaardt *et al.* (1992) compiled computer-based synoptic keys to facilitate rapid and reliable identification of certain taxa.

Diverse substrates from a wide range of localities have been studied. A number of the published records of collectors and the localities where these materials have been collected from are presented in Table 1.

TABLE I. Collection records by locality

LOCALITY	COLLECTOR
Alabama,	De Hoog & Morgan-Jones 1978; Morgan-Jones & Wiggens 1974; Matsushima 1981, 1983, 1985; Morgan Jones 1974, 1976, 1977a, 1977b, 1978, 1979, 1980, 1982a; Sinclair & Morgan-Jones 1979a, 1979b, 1979c
Alaskan Arctic,	Matsushima 1975, 1985
Antarctic material	Tubaki & Asano 1965
Argentina	Arambarri <i>et al.</i> 1997; Arambarri & Cabello 1995; Arambarri & Godeas 1994; Arambarri <i>et al.</i> 1987; Cabello <i>et al.</i> 1998; Cazau <i>et al.</i> 1993; Matsushima 1983, 1985, 1987.
Australia	Goh. & Hyde 1996; Matsushima 1985, 1989.
Brazil	Sutton & Hodges 1975
Canada	Castañeda Ruiz & Kendrick 1991; Hughes 1979a; Matsushima 1983, 1985, 1987; Sutton 1973a;
Canaries	Castañeda Ruiz <i>et al.</i> 1996.
Czechoslovakia	Holubová-Jechová 1982a, 1984
Chile,	Matsushima 1983, 1985
Cuba	Castañeda Ruiz 1985, 1986, 1987, 1988; Castañeda Ruiz & Arnold 1985; Castañeda Ruiz & Kendrick 1990a, 1990b, 1991; Castañeda Ruiz <i>et al.</i> 1998a, b & c; Holubová-Jechová 1982b, 1983a, 1987; Holubová-Jechová & Castañeda Ruiz 1986; Holubová-Jechová & Mercado Sierra 1982, 1984, 1986; Matsushima 1987;
Ethiopia,	Bhat & Sutton 1985a & 1985b
Florida	Sutton 1978a; Dyko & Sutton 1979
Guan	Matsushima 1981
Hungary	Revay 1987, 1988, 1993, Gönczöl & Revay 1985, Revay & Gönczöl 1989.
Illinois	Crane 1971, 1972, Shearer <i>et al.</i> 1976
India	Kamal & Morgan-Jones 1984; Matsushima 1985, 1987; Morgan-Jones <i>et al.</i> 1986; Pirozynski & Patil 1970; Rai & Rai 1995; Rao & De Hoog 1986; Rao & Rao 1964a & b; Rao & Reddy 1978, 1981; Rao <i>et al.</i> 1988; Sharma 1980; Subramanian & Sudha 1979; Varghese & Rao 1978, 1980
Italy	Lunghini 1994, Lunghini & Pinzari 1996
Ivory Coast	Rambelli <i>et al.</i> 1981
Japan	Matsushima 1971; 1975, 1981, 1983, 1985, 1987, 1989, 1993; Tubaki 1954, 1958; Tubaki & Yokoyama 1971;
Kenya	Kirk 1985
Malaysia	Kuthubutheen and Nawawi 1991a, 1991b, 1991c, 1991d, 1991e; Nawawi & Kuthubutheen 1987, Nawawi & Kuthubutheen 1990
Malawi	Sutton 1993
Mexico	Maggi & Persiani 1984, Mercado Sierra <i>et al.</i> 1995, Mercado Sierra <i>et al.</i> 1996.
Micronesia	Matsushima 1987
Netherlands	Holubová-Jechová 1973
New Zealand	Hughes 1965, 1966, 1971, 1978, 1979b; 1980a, 1980b, 1989; Hughes & Kendrick 1965, 1968; Matsushima 1985, 1987, McKenzie 1993
Ponape,	Matsushima 1981
Pacific Islands,	Matsushima 1983, 1985
Peru	Matsushima 1981, 1985, 1987, 1993
Seychelles	Matsushima 1981, 1983, 1985, 1987
The Solomon Islands and Papua-New Guinea	Matsushima 1971, Kobayasi, 1971.
Southern Monrovia	Holubová-Jechová 1972
Soviet	Melnik 1988.
Taiwan	Eicker <i>et al.</i> 1990, Chen & Hwangh 1993; Chen <i>et al.</i> 1989; Matsushima 1980, 1981, 1983, 1985, 1987; Tzean & Chen 1989a & b, 1991; Wingfield <i>et al.</i> 1994
Tanzania	Pirozynski 1972
Uganda	Matsushima 1981, 1983, 1985, 1987
United Kingdom	Kirk 1981a, b & c, 1982, 1983a, 1983b, 1986; Sutton 1978b
Venezuela	Crane & Dumont 1975, 1978

STUDY AREAS AND METHODS

Sampling sites

From May 1994 until the end of August 1994, pieces of decomposing wood and twigs were collected from different locations in Gauteng, Mpumalanga and the Western Cape Province. No attempt has been made to identify the different woody hosts, however, at all locations similar habitats were sought i.e. moist and sheltered wooded areas, frequently near running water courses.

The different biomes, vegetation types (Low & Rebelo 1996) and locations with grid references (Leistner & Morris 1976) where the pieces of decomposing wood were collected are presented in the table below:

Table 2. Collection sites

Biome	Vegetation Type	Location	Grid reference
Grassland	North-eastern Mountain Grassland	Mpumalanga Province, God's Window	24 30 DC Pilgrimsrest
		Mpumalanga Province, Graskop, Natural Bridge	24 30 DD Pilgrimsrest
	Rocky Highveld Grassland	Gauteng Province, Pretoria, Botanical Gardens	25 28 CA Pretoria
Fynbos	Sand Plain Fynbos	Western Cape Province, Tygerberg Reserve, Cape Town	33 18 DC Cape Town
		Western Cape Province, Klapmuts	33 18 DD Cape Town
	Central Mountain Renosterveld	Western Cape Province, Baines Kloof	33 19 CA Worcester
		Western Cape Province, Worcester	33 19 CB Worcester
		Western Cape Province, Du Toit's Kloof	33 19 CC Worcester
		Western Cape Province, Constantia	34 18 AB Simonstown
		Western Cape Province, Tokai Forest	34 18 AB Simonstown
		Western Cape Province, Noordhoek	34 18 AB Simonstown
	West Coast Renosterveld	Western Cape Province, Paarl	33 18 DB Cape Town
		Western Cape Province, Jonkershoek	33 18 DD Cape Town
		Western Cape Province, Muldersvlei	33 18 DD Cape Town
		Western Cape Province, Elsenberg	33 18 DD Cape Town

One collection was also made in the Northern Cape Province, in the Kalahari Gemsbok Park from a drying tuber of “Devil’s Claw”, *Harpagophytum procumbens* (Burch.) DC. ex Meissn. subsp. *procumbens* collected from South Africa, Kalahari Gemsbok Park, in the vicinity of Loffiesdraai:

Biome	Vegetation Type	Location	Grid reference
Savanna	Kalahari Dune Bushveld	Northern Province	25 20 AA Mata-Mata

Methodology

- **Collection, examination and isolation**

Collected material was taken to the laboratory in plastic bags so as to preserve moisture and placed in moist chambers at room temperature. The moist chambers consisted of petri dishes (or larger containers for larger pieces of wood) in which moist filter paper was placed and which were sealed with wax film (Parafilm "M", American Can. Co.).

- **Dissection microscopy**

Specimens were examined within approximately three weeks with a Nikon SMZ-10 dissecting microscope to detect growth and sporulation of the Hyphomycetes. Once colonies were located, slides were made using 26 gauge hypodermic needles to cut free and retrieve the sporulating structures from the substrate. The specimens were mounted in lactophenol cotton blue for subsequent morphological studies. Slides were preserved by sealing the cover slips with ordinary nail polish.

- **Light microscopy**

Slide specimens were then examined with a Nikon-Optiphot research microscope (LM) under 10X 20/0, 40 and/or 10X 40/0,65 and/or 10X 100/1,25 oil immersion

magnifications, in ordinary transmitted light as well as in phase contrast. All measurements were determined with the research microscope and a Leitz 12,5 calibrated ocular micrometer at maximum magnification under oil immersion. Fungi were photographed with a Nikon camera using 35 mm PAN F 50 ASA and FP4 125 ASA film.

- **Scanning electron microscopy**

The conidium surfaces, conidiomata and colony appearances of certain fungi were examined in a Jeol JSM-840 scanning electron microscope (SEM), operating at an accelerating voltage of 5-8 kV at a working distance of 17 - 27 mm. The examined material was photographed (at different magnifications) with a Mamiya RB 67 camera mounted on the scanning electron microscope. Ilford FP 4 (120 mm) film was used.

- **Culture studies**

Attempts were made to make pure cultures of the fungi collected. Conidia were picked off the colonies with a sterile needle with the aid of the dissecting microscope and inoculated onto plates of MEA (malt-extract agar) and PDA (potato dextrose agar). The recipes for the preparation of PDA and MDA agar media are to be found in "Biolab culture and media catalogue" pages 63 and 49 respectively. Incubation temperature was 25 °C. Cultures of isolated fungi were exposed to near ultra violet light to induce sporulation. Culture identification was made after sporulation. Non-sporulating cultures were discarded. Lactophenol mounted slide preparations were made for recording morphological characteristics of cultured isolates.

- **Deposition of specimens**

Specimens were deposited in the National Collection of Fungi, South Africa (PREM).

TAXONOMIC PART

A complete description of the specimens recorded (59 taxa of which one is a new genus, one is a new species and 43 are new records from southern Africa), with the localities, is provided.

The descriptions are in terms of the standard characters used in the taxonomy of Hyphomycetes i.e. type of conidiogenesis and other features connected with or resulting from the development of conidia and their secession. The shape and size of conidiogenous cells, development of conidia, shape, size and septation of conidia, different types of proliferation of the conidiogenous cells, branching pattern and arrangement of conidiophores, position of conidiogenous cells on conidiophores, pigmentation in conidia or conidiophores and the presence or absence of a stroma are all significant features for distinguishing taxa.

Measurements are mostly given in ranges, i.e. 5 - 28(19) μm , where the most common size recorded is given in parentheses. Size ranges were derived from at least 20 observations.

All descriptions are based on growth on the natural substrate unless otherwise stated.

Comments are made with respect to the individual collections, and where necessary, the genera they belong to and any relevant genera and species that should be of concern.

Photographs of the conidiophores and the conidia of the collected specimens are included to illustrate the descriptions.

Acrodictys deightonii M. B. Ellis, *Mycol. Pap.* **79**: 17, 1961.

Plate 1, figures 1 - 4.

Colonies effuse, black, hairy. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown to dark brown, smooth, 2 - 5 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in groups of 2 - 3 laterally on the hyphae, simple, erect, straight to slightly flexuous, cylindrical, septate, brown to dark brown, smooth, thick-walled, 80 - 220 μm long, 5 - 10 μm wide, tapering to 5 μm at the apex, percurrent with up to 6 successive barrel-shaped proliferations. *Conidiogenous cells* holoblastic, monoblastic, integrated, terminal, determinate or percurrent. *Conidia* acrogenous, solitary, dry, smooth, pale to dark brown, variable in shape, muriform with numerous transverse and longitudinal septa, slightly constricted at the septa, 30 - 40 μm long and 18 - 35 μm wide, with the peripheral cells swollen and protruding, sometimes with extensions that could be germ tube initials, basal cell protruding, obconical, pale brown, truncate at the base, 4 - 6 μm wide.

On bark of dead wood, South Africa, Mpumalanga Province, God's Window, May 31, 1994, R. C. Sinclair, PREM 57133.

Ellis's illustrations (1961) depicted the mature fungus while Pirozynski (1972) depicted the younger stages. The juvenile conidia have a distinctly lobed configuration, which becomes progressively obscured, as the conidia enlarge. The barrel-shaped percurrent proliferations of the conidiogenous cells and the dark brown conidia of highly variable shape depicted in Plate 1, figures 1 - 3, are characteristic of this species (Sutton 1969). Radiating projections were observed from the top of released conidia (Plate 1, figure 4) and it is postulated that these may be germ tubes.

This species has previously been recorded in Africa. Ellis (1961) recorded it from Sierra Leone and Pirozynski (1972) recorded it from Tanzania. To our knowledge this is the first recording of this fungus in southern Africa.

Acrodictys globulosa (Tóth) M. B. Ellis, *Mycol. Pap.*, **103**: 34, 1965.

Plate 1, figures 5 - 9.

Colonies effuse, brown to dark brown. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown to brown, smooth, 1 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in groups of 2 - 3 laterally on the hyphae, simple, erect, straight to slightly flexuous, brown to dark brown near the base, smooth, septate, cylindrical, thick-walled, 30 - 90 μm long, 6 - 8 μm wide, tapering to 4 μm at the apex, with up to 6 proliferations. *Conidiogenous cells* holoblastic, monoblastic, integrated, terminal, determinate or percurrent. *Conidia* acrogenous, solitary, dry, smooth, pale brown to dark brown, sub-globose, muriform with 2 or more indistinct transverse and longitudinal septa, slightly constricted at the septa, 30 - 36 μm long and 20 - 23 μm wide at the broadest part, basal cell protruding, cylindrical, pale brown, 5 - 6 μm wide.

On bark of dead wood, South Africa, Gauteng Province, Pretoria, Botanical Gardens, May 3, 1994, S. Boshoff, PREM 57134.

A. globulosa is characterised by proliferating conidiophores, sub-globose pale brown conidia with two indistinct transverse and longitudinal septa and an almost cylindrical protruding conidium basal cell. This Botanical Gardens specimen of *A. globulosa* differs in the number of conidium septa, but conforms in all other aspects.

Since its redescription by Ellis (1965) from Hungary and Sierra Leone several subsequent collections have been reported on a variety of substrates from different countries (Sutton 1993). However, apart from the single record from Sierra Leone,

Sutton's two collections from Malawi are the only others hitherto known from the African continent. To our knowledge this collection of *A. globulosa* is a new record for southern Africa.

Acrogenospora sphaerocephala (Berk. & Br.) M. B. Ellis, Dematiaceous
Hyphomycetes: 114, 1971.

Plate 1, figures 10 - 14.

Colonies effuse, dark brown to black, hairy. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, smooth, pale brown, 4 - 5 μm wide hyphae, superficial part pseudoparenchymatous, pale to mid-brown, composed of isodiametric cells, 5 - 10 μm in diameter, giving rise to the conidiophores. *Conidiophores* macronematous, mononematous, solitary or gregarious, simple, erect, straight or slightly flexuous, cylindrical, septate, dark brown, paler towards the apex, smooth, up to 500 μm x 9 μm (base) - 6 μm (middle) - 4,5 μm (apex), proliferating percurrently. *Conidiogenous cells* monoblastic, integrated, terminal, percurrent, cylindrical. *Conidia* acrogenous, single, dry, simple, globose, pale brown, smooth, aseptate, 20 - 30 x 20 - 30 μm .

On bark of dead wood, South Africa, Gauteng Province, Pretoria, Botanical Gardens, May 3, 1994, S. Boshoff, PREM 57135.

This species has previously been recorded in South Africa by Sinclair (1990) on dead decorticated wood, Mariepskop, N. E. Transvaal (now Mpumalanga), AUAM 2552. Sinclair identified his specimen in terms of the size of the conidia (22 - 28 μm long and 18 - 28 μm wide) and shape of its conidia (globose to sub-globose) as *A. sphaerocephala*, but noted that it is difficult to distinguish between *A. sphaerocephala* and *A. setiformis* (Wallr.) M. B. Ellis without having examined material of *A. setiformis*.

As the conidia of this Botanical Gardens specimen are completely globose and the size and shape of all other structures of this specimen conform to that of the type specimen, this specimen is identified as *A. sphaerocephala*.

Actinocladium rhodosporum Ehrenb. *Jb. Gewächskde*, 1: 52, 1819.

Plate 1, figure 15.

Colonies effuse, dark brown to black, hairy. *Mycelium* is immersed in woody substratum and mostly immersed but partly superficial on bark; composed of irregularly branched, septate, sub-hyaline to mid-brown, smooth, 2 - 5 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in small groups, terminally or laterally on the hyphae, simple, erect, straight to slightly flexuous, dark brown, paler towards apex, smooth, septate, cylindrical, thick-walled, up to 100 μm long, the base sometimes very slightly swollen (up to 12 μm wide) tapering to 2 - 4,5 μm at the thin-walled apex, sometimes percurrent. *Conidiogenous cells* holoblastic, monoblastic, integrated, terminal, determinate or percurrent. *Conidia* acrogenous, solitary, dry, smooth, pale to dark brown, stauriform, composed of a truncate 1 - 4-celled stalk, 7 - 23 μm long, 3 - 4 μm wide at the base, surmounted by a group of cells 9 - 12 μm thick, from which 3 (occasionally 2) arms radiate upwards and outwards at an angle of 30° - 80°, arms up to 80 μm long, base 7 - 10 μm thick, 2 - 4,5 μm at the rounded apex, 3 - 15-septate, sometimes slightly constricted at the septa, apices of the arms are paler than rest of conidium.

On bark of dead wood, South Africa, Western Cape Province - coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, and mountainous area, Elsenberg, part of Elsenberg Research Station, side of hill, south facing, with conifer the predominant tree species, August 10, 1994, R. C. Sinclair, PREM 57136.

The stauriform conidia of these specimens are quite typical. A conidium forms when a swelling of the thin-walled conidiophore apex (conidial initial) is cut off from the conidiophore by a septum and 1 - 4 transverse septa divide off the stalk cells. In the terminal swollen stalk cell an indistinct septum arises dividing it unequally and the

larger cell becomes transversely septate and originates one of the arms. The other two arms develop as lateral swellings from the smaller cell, which eventually becomes divided into two by a vertical septum. Variations in stalk length, size of central group of cells and length of arms result in marked differences in the general appearance of the conidia of this fungus.

This fungus has previously been recorded on decaying wood and bark of mostly hardwood trees from Europe and citrus trees from Sierra Leone (Ellis 1971). Hughes (1978) found it frequently in New Zealand and Holubová-Jechová & Mercado Sierra (1984) reported the species from Cuba. Sutton's (1993) collection of this species in Malawi is a further extension of its range in Africa. Hitherto, it has not been collected in South Africa, making it a new record for the country.

Alternaria alternata (Fr.) Keissler, *Beih Bot. Zbl.*, **29**: 434, 1912.

Plate 1, figures 16 - 20.

Colonies effuse, grey to dark brown or black. *Mycelium* partly superficial, mostly immersed in the substratum, composed of branched, septate, hyaline, olivaceous brown to brown, smooth, 3 - 6 μm wide hyphae. *Conidiophores* macronematous, mononematous, solitary or in small fascicles, erect, straight or flexuous, geniculated, simple or branched, septate, cylindrical, pale to pale brown, smooth, cicatrized, up to 65 μm long and 3 - 4 μm wide. *Conidiogenous cells* polytretic, integrated, terminal becoming intercalary. *Conidia* acropleurogenous, solitary or in straight, short chains, variously shaped, juvenile conidia obclavate, mature conidia ovoid, tapering gradually to a short hyaline awl-shaped beak, pale to clear golden brown, smooth to somewhat ornamented, generally with 4 - 8 transverse and several oblique longisepta, constricted at the septa, great variation in size, 12 - 50 - 90 μm x 8 - 16 μm .

On bark of dead wood. South Africa, Western Cape Province, mountainous area, Worcester, mountain pass, June 24, 1994, R. C. Sinclair, PREM 57137.

Species of this genus are usually host/substrate specific. *A. alternata*, however, is a saprotroph (plurivorous) found on many kinds of plants and other substrata including foodstuff, soil and textiles (Ellis 1971). This species has been previously recorded in South Africa (Eicker 1974; Papendorf 1976; Gorter 1977). Simmons (1995) provides an extensive coverage of the taxonomy of this species.

Alysidiopsis pipsissewae Sutton, *Mycol. Pap.* **132**: 5 - 8, 1973.

Plate 2, figures 1 - 5.

Colonies effuse, brown, hairy. *Mycelium* mostly immersed, more rarely superficial, composed of irregularly branched, septate, pale brown to brown, smooth, 3,5 - 10 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising directly from the immersed hyphae, separate, erect, rarely branched along the length, but frequently and irregularly so at the apex, thick-walled, tapered slightly towards the apices, 5 - 9-septate, 170 - 250 μm long and 5 - 12 μm wide. *Conidiogenous cells* holoblastic, monoblastic and polyblastic, integrated, terminal, variable in size and shape. *Conidia* in branched chains, acropleurogenous, dry, smooth, spherical to oval to limoniform to ellipsoidal or irregular, mostly aseptate, pale brown, frequently with protruding truncate denticles in non spherical forms, 5 - 20 x 5 - 10 μm .

On drying tuber of "Devil's Claw", *Harpagophytum procumbens* (Burch.) DC. ex Meissn. subsp. *procumbens* collected from South Africa, Kalahari Gemsbok Park, in the vicinity of Loffiesdraai, tuber dried in the garden of the University of Pretoria, May 9, 1995, R. C. Sinclair, PREM 57138.

In describing the monotypic genus, Sutton (1973) mentioned that the denticulate, polyblastic conidiogenous cells of *Alysidiopsis* Sutton resemble those in *Balanium* Wallr., but that in *Balanium* the conidiophores branch dichotomously and trichotomously and the conidia are solitary, acrogenous and consistently 1-septate and ellipsoidal, whereas in *Alysidiopsis* the conidiophores are irregularly branched towards

the apices and the conidia are catenate, 0 - 1-septate and more irregular in shape. However, to our minds the main distinction between *Alysiidiopsis* and *Balanium* is that the conidia of *Alysiidiopsis* develop schizolytically (formed by cleavage or splitting of middle-lamella of the walls) and those of *Balanium* rhexolytically (outerwall breakdown between/beneath conidia). The *Cladosporium*-like conidiogenous cell of *Alysiidiopsis* produces its first conidium holoblastically (conidial ontogeny) and delimits it (conidial delimitation). This conidium quickly becomes detached (conidial secession) and the conidiogenous cell proliferates enteroblastically (proliferation) to produce another conidium (conidial ontogeny). The second conidium is delimited by a septum (conidial delimitation) which occurs lower down the axis of the conidiogenous cell than the base of the new inner wall layer produced by the conidiogenous cell during the first proliferation. When the second conidium becomes detached (conidial secession) it takes with it all wall layers above the delimiting septum and the conidiogenous cell becomes physically shorter. These stages may then be repeated (Minter *et al.* 1982; 1983a).

Sutton (1973) also mentioned in his description of the genus that *Alysiidiopsis* is morphologically similar to *Bispora* Corda and *Taeniolella* Hughes, but that *Alysiidiopsis* differs in being constantly and distinctly macronematous, branched towards the conidiophore apices and with polyblastic conidiogenous cells.

Sutton (1973) furthermore stated that although *Alysiidiopsis* and *Alysidium* Kunze ex Steudel have similar features such as dry catenate conidia, often in branched chains and similar conidial shape, the main differences between the two genera are the restriction of conidiogenous activity to the apices of macronematous conidiophores and the aseptate conidia which are pale brown except in the darker denticular areas in *Alysiidiopsis* as opposed to the rather diffuse location of conidiogenous cells along the generally micronematous or semi-macronematous conidiophores and aseptate, consistently concolorous conidia in *Alysidium*.

Sutton recorded *Alysidiopsis pipsisewae* from peduncular hairs. To our knowledge this Kalahari Gemsbok Park specimen recorded from a drying tuber of “Devil’s Claw” constitutes the first collection of this fungus in southern Africa.

Balanium stygium Wallroth, *Flora Cryptogamica Germaniae* **2**: 160, 1833.

Plate 2, figures 6 - 8.

Colonies effuse, black, velvety. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown to dark brown, smooth, 4 - 8 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising terminally on the hyphae, successively branched, dichotomously or trichotomously, erect, straight, brown to dark brown, end branches paler, smooth, septate, 5 - 18 μm wide; terminal branches at point of abscission of conidia 3 - 7 μm wide. *Conidiogenous cells* holoblastic, polyblastic, integrated, terminal, determinate, cylindrical, denticulate with broad, cylindrical separating cells. *Conidia* acrogenous, solitary at tip of each terminal branch, the end wall of each terminal branch enlarges to form dry, smooth, very dark brown to black, more or less oval conidia, 1-septate, 20 - 28 μm long, 12 - 20 μm thick with a slightly protruding and truncate base, 3 - 4 (occasionally up to 7) μm wide.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Baines Kloof, mountain pass, along road side, June, 24, 1994, R. C. Sinclair, PREM 57139.

A very distinct species because of the characteristic separating cell: in conidial development the end wall of each terminal branch enlarges to form a conidium and two cross walls are laid down a short distance from each other inside the narrow, thin-walled part of the branch immediately below the developing conidium to form a short, narrow, pale-coloured separating cell. When the conidium is mature, the branch breaks at a point equidistant from each septum (Ellis 1961), i.e. rhexolytic development.

This species has previously been recorded from, amongst others, Belgium, Germany and Great Britain (Ellis 1971). To our knowledge this collection represents the first collection from southern Africa.

Bispora betulina (Corda) Hughes, *Can. J. Bot.* **36**: 740, 1958.

Plate 2, figures 9 - 10.

Colonies effuse, powdery, dark brown to black. *Mycelium* mostly immersed in the substratum, composed of branched, septate, sub-hyaline to pale brown, smooth, 2 - 3,5 μm wide hyphae. *Conidiophores* semi-macronematous, mononematous, solitary or in loose fascicles of a few, erect, simple, straight, somewhat conical, septate, pale brown to brown, smooth, 5 - 10 μm x 4 - 5 μm . *Conidiogenous cells* monoblastic, determinate, integrated, terminal, cylindrical. *Conidia* acrogenous, catenate, simple or branched, cylindrical, rounded at the ends, mostly 1-septate, occasionally 2- or more septate, septa dark, smooth, brown to dark brown, up to 12 - 36(18) μm long and 4 - 8(7) μm wide.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Du Toit's Kloof, in deep kloof in wooded area, June 25, 1994, R. C. Sinclair, PREM 57140.

From their respective descriptions *B. betulina* appears to be very close in morphology to *B. antennata* (Pers. ex Pers.) Mason. *B. betulina* differs in having slightly smaller conidia and shorter conidiophores. We identify our specimen as *B. betulina* given the shape of its conidia and the number of septa of its conidia and the fact that although the septa are dark, they do not form dark bands.

A common fungus on dead wood, collected in Canada, Europe, USA and the UK (Ellis 1971). To our knowledge this is the first record of the fungus from southern Africa.

Brachydesmiella biseptata Arnaud ex Hughes, *Can J. Bot.*, **39**: 1095, 1961.

Plate 2, figures 11 - 13.

Colonies effuse, black, shiny. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown to brown, smooth, 3 - 4 μm wide hyphae. *Conidiophores* macronematous, mononematous, single or scattered in small groups, usually simple, erect, straight or irregularly geniculate, hyaline to pale brown, smooth, continuous or septate, thick-walled, up to 30 μm long, 4 μm wide at base, gradually expanding to 5 - 8 μm wide towards the apex. *Conidiogenous cells* monotretic or more often polytretic, sympodial, integrated, terminal, cylindrical with 1 - 4 hyaline scars with pale brown peripheral zones. *Conidia* acropleurogenous, solitary, dry, limoniform, nearly always 2-septate, smooth, dark to almost black, unequally coloured, the central cell large and smooth, brown to almost black, the end cells small, very pale, usually verrucose or echinulate, conidia 28 - 47(42) μm x 14 - 22(20) μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Elsensberg, part of Elsensberg Research Station, side of hill, south facing, with conifer the predominant tree species, August 10, 1994, R. C. Sinclair, PREM 57141.

A very distinct species because of the large, dark central cell and the hyaline to pale brown ornamented end cells. Although most of the conidia of the present fungus are typically 2-septate and the central cell is very large, abnormal conidia which lack the small distal cell are not uncommon (Plate 2, figures 13F - 13H).

Specific descriptions and illustrations of *B. biseptata* are given by Arnaud (1953), Hughes (1961; 1971), Ellis (1971), Tubaki (1975), Matsushima (1983) and Révay (1988). To our knowledge this is a new record for southern Africa.

Brachysporiella gayana Batista, *Bolm Secr. Agric. Ind. Com. Est. Pernambuco*
19: 108 - 109, 1952.

Plate 3, figures 1 - 2.

Colonies effuse, brown to black, hairy. *Mycelium* immersed or partly superficial, composed of branched, septate, smooth, brown, 6 - 8 μm wide hyphae. *Conidiophores* macronematous, mononematous, frequently with one or several short branches near the apex, erect, straight or flexuous, septate, brown to dark brown, smooth, up to 250 μm long, 6 - 12 μm thick at the base, 5 - 7 μm in the middle, 3 - 4 μm at the apex. *Conidiogenous cells* monoblastic, integrated, terminal, percurrent, cylindrical, doliiform or lageniform, forming successive ovoid to obpyriform proliferations (the conidiophore may proliferate through the open end of the conidiophore apical cell after the first conidium is shed and when this happens, such proliferation first leads to the development of a simple apical flask-shaped conidiogenous cell; this process may be repeated) and as a result the tip of a mature conidiophore presents a beaded appearance with constrictions at the septa. *Conidia* acrogenous, solitary, simple, predominantly 3-septate (rarely 2- or 4-septate), brown, smooth, cells unequally coloured, with the apical cell the darkest and the base of the conidium slightly paler, dark brown to black bands at the septa, clavate, 20 - 30 μm long, 12 - 14 μm thick in the broadest part, 3 - 4 μm wide at the base. Often 1 - 2(3) of the flask-shaped conidiogenous cells are shed along with the conidia produced on them.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Worcester, mountain pass, June 24, 1994, R. C. Sinclair, PREM 57142.

Hughes (1958) established the genus *Monotosporella* Hughes for species with unbranched (simple), percurrent conidiophores. Ellis (1959) transferred the type species *M. setosa* (Berk. & Curt.) Hughes to *Brachysporiella* Bat., a genus that has erect conidiophores with short branches. However, Rao and De Hoog (1986) accepted the genus when they described a new species of *Monotosporella* with unbranched (simple) conidiophores.

Subramanian (1958) described the genus *Edmundmasonia*, but omitted any reference to similar or related genera. In a later publication he stated that *Edmundmasonia pulchra*, the type species of the genus, resembles *Brachysporiella gayana* in all details except the occurrence of stromata from which the conidiophores arise (Subramanian 1971). Hughes (1979a) regarded *Edmundmasonia* as a synonym of *Brachysporiella*. However, Holubová-Jechová (1983b) observed that the conidiogenous cells of *Edmundmasonia villosa* detach easily from the conidiophore, leaving only minute, clear pores in the lateral walls of the hyphae, conidiophore and conidiogenous cells, and leaving no wall remnants on the conidiophore or the conidium. Matsushima's figures of *Edmundmasonia pulchra* (Matsushima 1975) have small clear pores in the walls of the conidiogenous cells after secession, which cannot be observed in the walls of the conidiophores of *Brachysporiella gayana*. Thus, Holubová-Jechová (1991) concluded that the two genera are distinct taxa. Rao & De Hoog (1986) acknowledged that, although there are no fundamental differences between *Brachysporiella* and *Edmundmasonia*, they were reluctant to lump all *Brachysporiella*-like species together and decided to maintain the three genera (*Brachysporiella*, *Edmundmasonia* & *Monotosporella*). However, Hawksworth *et al.* (1995) listed *Edmundmasonia* as a synonym of *Brachysporiella*. Partridge *et al.* (1999) also accepted Hughes' decision.

Lunghini & Rambelli (1978) described a monotypic genus *Dendryphiosphaera* which is characterised by large conidiophores with crowded, globose, often catenulate conidiogenous cells in the apical zone and ellipsoidal conidia with parallel lateral walls, the septa being equally spaced. Although Rao & de Hoog (1986) admitted that there are no apparent fundamental differences between *Dendryphiosphaera* Lunghini & Rambelli and *B. gayana*, the type species of *Brachysporiella* they described a new species of *Dendryphiosphaera*.

Although the above four genera have many similarities, this Worcester specimen is identified as *Brachysporiella gayana*. This constitutes a new record for southern Africa.

Brachysporium bloxami (Cooke) Sacc. *Syll. Fung.* **4**: 426, 1886.

Plate 3, figures 3 - 7.

Colonies effuse, brown to dark brown, hairy. *Mycelium* mostly immersed, composed of branched, septate, brown, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, single or in groups, simple, erect, straight or slightly flexuous, cylindrical, septate, brown to dark brown, hyaline at the apex, smooth, up to 180 μm long, often swollen at the base to 8 - 10 μm , 4 - 6 μm just above the base, tapering to 3 - 5 μm at the apex. *Conidiogenous cells* holoblastic, polyblastic, sympodial, integrated, terminal, cylindrical, denticulate, the conidia being borne at the ends of 3 μm long x 1 μm wide, sometimes twisted, narrow, hyaline cylindrical pedicels. *Conidia* acropleurogenous, solitary, dry, smooth, pyriform, pendulous, 3-septate, 21 - 30 x 9 - 15 μm , basal cell small, pale, other cells much larger, mid-pale to dark brown.

On bark of dead wood, South Africa -

Mpumalanga Province, God's Window, May 31, 1994, R. C. Sinclair; and

Western Cape Province -

mountainous area, Baines Kloof mountain pass, along road side, June 24, 1994, R. C. Sinclair; and

coastal area, Tokai Forest, Ladies Mile road, open area near stream, July 2, 1994, R. C. Sinclair, PREM 57143.

When the conidia become detached, the pedicel is fractured; part of it remains attached to the conidiophore and part to the base of the conidium.

A common fungus on rotten wood and bark of various trees in Belgium and Great Britain (Ellis 1971). It has also been collected in Hungary (Révay 1993).

To our knowledge our collections constitute the first collections of this fungus in southern Africa.

Camposporium antennatum Harkness, *Bull. Calif. Acad. Sci.* 1: 37 - 38, 1884.

Plate 3, figures 8 - 9.

Colonies effuse, grey, brown, velvety. *Mycelium* immersed, composed of branched, septate, hyaline to light brown, smooth, 2,5 μm - 3(3,5) μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in small groups, simple, erect, straight to flexuous, often irregularly bent, cylindrical, up to 12-septate, brown to dark brown, paler towards the apex, smooth, up to 100 μm long, 5 - 7 μm wide. *Conidiogenous cells* holoblastic, polyblastic, sympodial, integrated, terminal, cylindrical, denticulate; each denticle a narrow, cylindrical, 6 -10 μm long x 1,5 μm wide pedicel which functions as a separating cell. *Conidia* acrogenous, solitary, dry, smooth, pale olive to brown, almost hyaline at the extremities, cylindrical with rounded ends, 45 - 70 x 6 - 10 μm , 7 - 10-septate, the apical cell often bears 1 - 3 filiform, non-septate setulae, up to 25 μm long and 1 μm thick. Conidium base may bear a scar with a small frill, which is the remains of the ruptured separating cell.

On bark of dead wood, South Africa, Western Cape Province - mountainous area, Baines Kloof, mountain pass, along road side, June 24, 1994, R. C. Sinclair, and coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, and Tokai Forest, Ladies Mile road, open area near stream, July 2, 1994, R. C. Sinclair, PREM 57144.

The conidia of *Brachysporium* Saccardo *spp.* and *Camposporium* Harkness *spp.* are produced similarly, i.e. acrogenously and solitary on a cylindrical stalk, however, the conidia of *Camposporium* *spp.* are cylindrical with the potential to develop one or more appendages from the apical cell (Subramanian 1971), while the conidia of *Brachysporium* *spp.* are not cylindrical and do not have appendages (Hughes 1951).

Crous *et al.* (1996) recorded this species as one of the numerous Hyphomycetes isolated while studying the microfungi associated with *Podocarpus* leaf litter in South Africa.

Another collection of this species in South Africa was made by Hyde *et al.* (1998) from submerged wood in the Palmiet River, Durban.

Catenularia anam. state of *Chaetosphaeria innumera* Tul., *Sel. Fung. Carpol.* **2**: 252, 1863.

Plate 3, figures 10 - 12.

Colonies effuse, dark brown, hairy. *Mycelium* immersed in the substratum, composed of branched, septate, hyaline to light brown, smooth, 3 - 5 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in small groups, simple, erect, simple, straight or flexuous, cylindrical, septate, brown, paler towards the apex, smooth, up to 150 (110) μm long, 3 - 5 μm wide, terminating in a solitary phialide with a cylindrical collarette. *Conidiogenous cells* monophialidic, integrated, terminal, percurrent, calyciform. *Conidia* endogenous, sometimes shortly catenate, slimy groups, simple, ellipsoidal, hyaline, smooth, aseptate, 2,5 - 5 μm x 2 - 3 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Paarl, Paarl Nature Reserve, mixed conifer wooded hillside, August 10, 1994, R. C. Sinclair, PREM 57145.

In Plate 3, figure 10, the conidium attachment to the cytoplasm within the thickened outer wall of the conidiogenous cell appears to have everted and the origin appears to be denticulate. However, in Plate 3, figures 11 - 12, the endogenous origin of the conidia is clearly depicted.

Hughes (1965) reviewed the history of the genus *Catenularia* Grove and discussed the characteristics of the genus. He suggested that the characteristic lacking of capitate hyphae by *Catenularia* anam. state of *Chaetosphaeria innumera* and its obclavate, hyaline and small conidia are characters of *Chloridium* Link, rather than of *Catenularia*. However, Ellis (1976) continued to list this fungus as *Catenularia* anam. state of

Chaetosphaeria innumera. Until further study, we record this specimen in the genus *Catenularia*. To our knowledge this collection constitutes the first record of this species from southern Africa.

Chalara aurea (Corda) Hughes, *Can. J. Bot.* **36**: 747, 1958.

Plate 3, figures 13 - 15.

Colonies effuse, pale brown with white surface due to spores, velvety to hairy. *Mycelium* partly superficial, mostly immersed, composed of a loose network of branched, septate, hyaline to pale brown, smooth, 1,5 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, simple, erect, straight to flexuous, cylindrical, up to 8-septate, brown to pale brown, getting progressively paler to almost hyaline at the tips, walls smooth and 1 μm thick, 60 - 80(65) μm long and 4 - 7(5) μm wide at the base, terminating in a phialide, sometimes geniculate with a re-growth of up to 60 μm . *Conidiogenous cells* monophialidic, integrated, terminal, determinate, seldom percurrent, brown to pale brown, lageniform, 21 - 70 μm long; venter cylindrical, 9 - 25 x 3,5 - 8 μm ; collarete cylindrical, 12 - 45 x 2 - 3 μm ; transition from venter to collarete abrupt. *Conidia* endogenous, catenate, occasionally single, cylindrical with rounded apex and truncate base, or with both ends rounded, 1-septate, hyaline, smooth-walled, 9 - 19(12) x 1,5 - 3 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, PREM 57146.

Holubová-Jechová (1984) remarked that all new information on morphological characters and variation in the size and the shape of conidiophores, phialides and conidia of *Chalara* spp. are valuable for the knowledge of the genus, as in spite of the monograph on this genus by Nag Raj and Kendrick (1975), collections of *Chalara* are mostly difficult to allocate satisfactorily to a correct species as the specimens practically always differ from the descriptions given by the monographers.

Given that this Tygerberg Reserve specimen has long conidiophore stipes, lageniform conidiogenous cells and septate catenate conidia it is recorded as *Chalara aurea*.

This fungus has previously been collected in Austria, Czechoslovakia and the UK on wood and horse chestnut fruits (Ellis 1971; Nag Raj & Kendrick 1975). To our knowledge this is a first record of this fungus for southern Africa.

Chalara hughesii Nag Raj & Kendrick in Nag Raj & Hughes, *N. Z. Jl. Bot.* **12**: 118, 1974.

Plate 3, figures 16 - 18.

Colonies effuse, dark brown to black, hairy or velvety. *Mycelium* superficial, phialophores arising from a stromatic layer of thick-walled, brown, cuboid cells. *Conidiophores* macronematous, mononematous, phialidic, in groups, simple, straight or slightly flexuous, pale brown, smooth, up to 75 µm long including the conidiogenous cell. *Conidiogenous cells* monophialidic, integrated, terminal, determinate, lageniform, brown, 40 - 60 µm long; venter light brown, sub-cylindrical to sub-ellipsoidal, 10 - 20 x 5 - 9,5 µm, collarete pale brown, cylindrical, 20 - 40 x 2 - 3 µm; transition from venter to collarete gradual to abrupt. *Conidia* endogenous, catenate, cylindrical with rounded ends, hyaline, 1-septate, 11 - 19 x 2 - 3 µm, smooth walled, lacking a basal marginal frill.

On bark of dead wood, South Africa, Gauteng Province, Pretoria, Botanical Gardens, April 3, 1994, S. Boshoff, PREM 57147.

Chalara hughesii differs from *Chalara aurea* mainly in its lack of a long conidiophore stipe.

Known locations of this fungus are New Zealand, the U. S. A. (Nag Raj & Kendrick 1975) and Czechoslovakia (Holubová-Jechová 1984). To our knowledge this is a new record of this fungus for southern Africa.

Chalara inflatipes (Preuss) Sacc., *Syll. Fung.*, **4**: 335, 1886.

Plate 4, figures 1 - 2.

Colonies effuse, dark brown to black, hairy or velvety. *Mycelium* mostly immersed or partly superficial, composed of branched, septate, hyaline, smooth, 2 - 4 µm wide hyphae. *Conidiophores* macronematous, mononematous, solitary or in groups of up to 4, simple, straight or slightly flexuous, dark brown, smooth, 130 - 180 µm long, with a 1 - 6-septate, 10 - 12 µm wide basal stalk followed by a swollen, non-septate region, 12 - 15 µm and a cylindrical tube, 8 - 9 µm wide, open at the apex with an irregularly torn wall; terminating in a phialide. *Conidiogenous cells* monophialidic, integrated, terminal, determinate, sub-cylindrical to lageniform, dark brown, 66 - 100(80) µm long; venter light brown, sub-cylindrical to ellipsoidal, 28 - 61(43) x 9,5 - 17(12) µm, collarete light brown, cylindrical, 40 - 100 x 5,5 - 10(8) µm; transition from venter to collarete abrupt. *Conidia* endogenous, extrude singly or in short chains, cylindrical with rounded ends, hyaline, usually 7-septate, 35 - 65 x 6 - 9 µm, smooth walled and unstricted at septa.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Jonkershoek, wooded area near stream, July 3, 1994, R. C Sinclair, PREM 57148.

This specimen is differentiated from the other two recorded *Chalara spp.* mainly by its multiseptate conidia.

C. insignis (Sacc. Rouss. & Bomm.) Hughes had been regarded as a synonym of *C. inflatipes* (Nag Raj & Kendrick 1971). But, because of a personal comment made by Hughes to the effect that he considered that, before such a synonymy could be accepted, the gap between these two species would need to be bridged by more collections than were available at that time, Nag Raj and Kendrick (1975) maintained them as distinct. Ellis (1976), however, regarded them as synonymous.

Known locations of this fungus are Central Europe, the USSR and Czechoslovakia (Holubová-Jechová 1984). To our knowledge this is a first record of this fungus for southern Africa.

Chloridium clavaeforme (Preuss) Gams & Hol.-Jech. *Stud. Mycol.* **13**: 31, 1976.

Plate 4, figure 3.

Colonies effuse, olivaceous to light brown to dark brown, hairy. *Mycelium* partly superficial, mostly immersed, composed of pale brown to brown, branched, septate, 3 - 4 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, simple, erect, cylindrical, septate, smooth, hyaline to brown, 45 - 90(70) (with proliferation) x 2.5 - 4 μm , base swollen, then narrows slightly to 2 - 3.5 μm at the flaring 3,5 - 4 μm wide vase-shaped collarete. *Conidiogenous cells* monophialidic, integrated, terminal, determinate, darker at the flaring, more or less cylindrical collarete, slightly wider than deep, usually almost the same, collarete up to 4 μm deep. *Conidia* endogenous, forming slimy heads, single, cuneate to triangular, smooth, hyaline to slightly pigmented, 3 x 2.5 μm , narrow at base, 1 μm at point of origin.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tokai Forest, Ladies Mile road, open area near stream, July 2, 1994, R. C. Sinclair, PREM 57149.

The main character for the generic delimitation of *Chloridium* Link is the unbranched, pluricellular, strongly pigmented conidiophore with an integrated phialide. *C. clavaeforme* is characterised by its vase-shaped collarettes and pigmented cuneate to triangular conidia.

W. Gams and V. Holubová-Jechová (1976) mentioned that the conidial state of this fungus is extremely common on very many kinds of wood. To our knowledge this is a first record of this fungus for southern Africa.

Chloridium smithii Sinclair & Eicker, *Trans. Br. Mycol. Soc.* **84**: 566, 1985.

Plate 4, figure 4.

Colonies effuse, brown to dark brown, hairy. *Mycelium* mostly immersed in the substratum, composed of branched, septate, sub-hyaline, smooth, 2 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising mostly in groups, simple, erect, straight to slightly flexuous, cylindrical, septate, brown, smooth, 50 - 150 μm x 3 μm . *Conidiogenous cells* monophialidic, integrated, terminal, proliferating percurrently, hyaline, flask-shaped, 15 μm long x 5 - 6 μm wide at swollen base, constricting to 0,5 μm and expanding in a flaring 2 μm wide x 1,5 μm deep collarette, collarette remnants lateral on conidiogenous cells. *Conidia* solitary within the collarette, globose, aseptate, hyaline, smooth, 1,5 μm x 1,8 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tokai Forest, Ladies Mile road, open area near stream, July 2, 1994, R. C. Sinclair, PREM 57150.

South Africa is the type locality of this fungus where it was recorded on a dead twig, Transvaal (now Mpumalanga), Dullstroom District, April 18, 1983, H M Smith, PREM 47375.

The collarette remnants appearing laterally on the conidiophores are a diagnostic feature for this species.

This represents the second recording of this fungus from southern Africa.

Chloridium transvaalense Morgan-Jones, Sinclair & Eicker, *Mycotaxon* 17: 302, 1983.

Plate 4, figures 5 - 9.

Colonies effuse, brown, hairy. *Mycelium* mostly immersed in the substratum, composed of branched, septate, sub-hyaline, smooth, 2 μm wide hyphae. *Conidiophores* macronematous, mononematous, solitary or in groups, simple, erect, straight to slightly flexuous, cylindrical, septate, pale brown, smooth, 40 - 120 μm x 4 - 6 μm . *Conidiogenous cells* phialidic, integrated, terminal, phialides arising from different points along the conidiophore in groups of 2 or more subtending a conidiophore septum, cylindrical to clavate, up to 5 μm wide in the broader middle section, up to 50(20) μm long, bearing an abruptly flaring collarete. *Conidia* solitary, successively, aggregating in slimy masses, oblong, aseptate, hyaline, smooth, 3 - 4 μm x 1,5 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tokai Forest, Ladies Mile road, open area near stream, July 2, 1994, R. C. Sinclair, PREM 57151.

South Africa is the type locality of this fungus where it was recorded on a dead, unidentified leaf from forest leaf litter, N. E. Transvaal (now Mpumalanga), Mariepskop, December 1, 1981, R. C. Sinclair, AUAM 2593.

Although the multiple phialides appearing in a verticillate arrangement (Plate 4, figures and 7) were not described in the type description, we identify our specimen as *C. transvaalense* given the other similarities, amongst others, the flask-shaped phialide with flaring collarete. The multiple phialides appearing in a verticillate arrangement are considered as a discovery of a variant in what was thought to be a clear-cut character (Hawksworth & Mouchacca 1994) and, therefore, do not justify the establishment of a new taxon.

This represents the second recording of this fungus from southern Africa.

Coniosporium anam. state of *Hysterium insidens* Schw., *Trans. Am. phil. Soc. N. S.* **4**:
244, 1832.

Plate 4, figures 10 - 14.

Sporodochia pulvinate, dark brown, isodiametric stromatic cells, pale brown to dark brown, 4 - 8 μm . *Mycelium* immersed, composed of branched, septate, hyaline to brown to dark brown, smooth, sometimes thickly walled, 4 - 6 μm thick hyphae. *Conidiophores* macronematous or semi-macronematous, in dense fascicles, erect, cylindrical, septate, brown, simple, rough walled, up to 10 μm long and 4 - 8 μm wide. *Conidiogenous cells* integrated, terminal, meristematic, brown, cylindrical, 25 - 35 μm x 4 - 8 μm . *Conidia* schizogenous, catenate, dry, simple, at first with 3 - 5 transverse septa only, later dictyoseptate, slightly constricted at septa, brown, thick-walled with irregular build-up of wall material, oblong to sub-cylindrical, rounded at the ends, 28 - 85(36) μm x 14 - 24(10) μm . Conidia carry on maturing after demarcation and during the elongation of the chain of conidia.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Klappmuts, low lying area near standing water (small vlei) on the edge of a fallow grape vineyard and cattle and horse pasture, wattle the predominant tree species, June 12, 1994, R. C. Sinclair, PREM 57152.

Our specimen differs from the description by Ellis (1971) in that the conidia from our specimen are slightly larger and not verrucose as in Ellis's description, but coarsely ornamented with irregular accumulations of cell wall material. Another difference is that the conidia of our specimen are slightly constricted at the septa. Occasionally, irregularly shaped conidia occur, caused by deviations in their longitudinal growth. These differences are considered as variances and, therefore, do not justify the establishment of a new taxon.

Ellis noted that this is a common fungus and indicated South Africa as a previously recorded locality. Gorter (1979) listed *H. insidens* Schw. in his annotated check list.

Talbot (1951) noted that a conidial state of *H. insidens* occurred on *Acacia mollissima* twigs at Atholl Experimental Station in Mpumalanga and recorded it as *Septonema spilomeum* Berk. Hughes (1958) placed *Septonema spilomeum* in synonymy with *Coniosporium* state of *Hysterium insidens*.

Cylindrotrichum probosciophorum (DiCosmo, Berch & Kendrick) Arambarri & Cabello, *Mycotaxon* **32(2)**: 437, 1988.

Plate 5, figures 1 - 2.

Colonies effuse, grey to blackish brown, hairy. *Mycelium* mostly superficial, composed of branched, septate, sub-hyaline to pale brown, 1,5 - 3 µm wide hyphae. *Conidiophores* macronematous, mononematous, setiform, solitary or scattered to gregarious, often in fascicles, simple, straight or sometimes flexuous, erect, cylindrical, tapering slightly towards the apex, multi-septate, thick-walled, dark brown below, paler above, smooth-walled, 45 - 360 x 2,5 µm (at the apex) - 5,5 µm (at the base), often proliferating through the broken end of an existing conidiophore to produce a new fertile apex. *Conidiogenous cells* integrated, sympodial, frequently showing a short, narrow, tubular, fertile extension. *Conidia* solitary, cylindrical, rounded ends, dry, hyaline, smooth, 1-septate, 11 - 20 µm x 2 - 2,5 µm.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Klapmuts, low lying area near standing water (small vlei), on the edge of a fallow grape vineyard and cattle and horse pasture, wattle the predominant tree species, June 12, 1994, R. C. Sinclair and Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, PREM 57153.

Over the years the genus *Cylindrotrichum* Bonorden has been revised a number of times. DiCosmo *et al.* (1983) reviewed the history of the genera *Cylindrotrichum* Bonorden and *Chaetopsis* Greville, and made an analysis of relevant anamorph generic concepts, which showed that there was insufficient justification for maintaining them as separate anamorph genera. Two new genera *Kylindria* DiCosmo, Berch et Kendrick and *Xenokylindria* DiCosmo, Berch et Kendrick were introduced to include monophialidic species previously

placed in *Cylindrotrichum*. The authors reduced *Cylindrotrichum* to synonymy with *Chaetopsis* and amended the generic concept of *Chaetopsis* appropriately. They foresaw that it could be suggested that they were "radical" in merging two genera that had maintained separate existences for well over a century. However, they suggested that the features of the conidiogenous cells and conidia were of more taxonomic significance than the presence or absence of setae. This view on taxonomic significance is supported by reputable references in the literature - see Hughes & Kendrick (1968) where *Codinaea* Maire, as monographed by them, includes setose and non-setose species, as well as one in which the conidiogenous cells often arise on the setae.

Rambelli and Onofri (1987) amended the generic diagnosis of *Kylindria*, described a new species of *Kylindria* and maintained or reinstated *Cylindrotrichum* as a separate genus (as the conidiogenous cells of *Cylindrotrichum* are always integrated at the apex, whereas those of *Chaetopsis* are lateral to the main axis of the setiform conidiophore).

Cabello & Arambarri (1988) considered the proposal of DiCosmo *et al.* as incorrect and concluded that *Cylindrotrichum* is a valid genus with erect, simple conidiophores, and conidiogenous cells terminal with single or multiple conidiogenous loci produced by sympodial or percurrent proliferation. *C. probosciophorum* is listed as one of the eleven species accepted.

Arambarri and Cabello (1989) did a cluster analysis by the unweighted pair group method using arithmetic averages on morphological data from 28 characters of 114 species of some dematiaceous phialidic genera of Hyphomycetes. They concluded that *Cylindrotrichum* Bonorden, *Chloridium* Link ex Fries and *Zakatoshia* Sutton are closely related and the differences between them are based only on the morphology of the conidia. Herewith a re-emphasis is made on the importance of conidial morphology in Hyphomycete taxonomy.

To our knowledge this is a first record of this fungus for southern Africa.

Dendryphiopsis anam. state of *Amphisphaeria incrustans* Ellis & Everh., N. Am. Pyrenom.: 201, 1892.

Plate 5, figures 3 - 4.

Colonies effuse, black, hairy. *Mycelium* immersed in the substratum, composed of branched, septate, pale brown, smooth, 4 - 6 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising solitary, branched towards the apex, erect, straight to slightly flexuous, cylindrical, septate, brown, smooth, stipe up to 440 μm long x 8 - 10 μm wide, branches paler than stipe, septate, cylindrical, 20 - 35 x 6 - 9 μm . *Conidiogenous cells* monotretic, integrated, terminal, determinate. *Conidia* solitary, acrogenous, simple, cylindrical, obtuse at each end, 2 - 5-septate, pale brown, thick-walled, smooth, 50 - 85 μm long x 12 - 25 μm wide.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, PREM 57154.

Conidia have 4 or more transverse septa. Conidia are typically cylindrical, but slightly curved conidia with inconsistent mild constrictions at the septa (giving it a beaded shape) occur. The conidia of our specimen are matured and no longer attached to the conidiophores.

This species was previously collected by Talbot (1956) on fallen *Populus deltoides* Marsh., "Goedehoop", Piet Retief District, April 1954 PREM 40993. Further collections of this fungus were made on dead wood, Mboyti, Transkei (now Eastern Cape), December 1982, R. C. Sinclair, AUAM 2549 and on dead decorticated wood, Serala State Forest, near Tzaneen, N. E. Transvaal (now Northern Province), April 1986, A. Eicker, PREM 48915 (Sinclair 1990).

Dicranidion fragile Harkness, *Bull. Calif. Acad. Sci.* 1: 163, 1885.

Plate 5, figures 11 - 13.

Colonies effuse, pale. *Mycelium* mostly immersed, partly superficial, composed of interwoven, hyaline, simple or branched, septate, 1 - 3 μm wide hyphae. *Conidiophores* macronematous, clustered, simple or branched, septate, straight or somewhat flexuous, slightly ampulliform, denticulate, hyaline, up to 13 μm long, 2 μm wide. *Conidiogenous cells* polyblastic, integrated, terminal, discrete, sympodial, cylindrical, denticulate, denticles cylindrical, fragile. *Conidia* acrogenous, solitary, dry, hyaline, bilobate, forking lobes parallel to each other, up to 25 μm long, 2- 3 μm wide, 3 - 6-septate, the one lobe usually with one or more septa more than the other.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Elsberg, on Elsberg Research Station, between pasture and vineyard coursing up side of hill in drainage area, thickly wooded, rough terrain, August 10, 1994, R. C. Sinclair, PREM 57155.

Tubaki (1958) recorded *D. fragile* Harkness from dead stems collected from Tokyo. He managed to make a pure culture of the fungus on malt agar and described and illustrated his observations, amongst others, that on the natural substrate many short branches are produced in whorls at the apices of the conidiophores as opposed to the zigzag-formed conidiophores produced in the culture. Butterfield (1973) also did cultural studies of *D. fragile*. He studied single conidium isolates of strains of *D. fragile* and revealed extensive variation in conidial morphology.

To our knowledge this recording constitutes the first record of this fungus from southern Africa.

Dictyochaeta anam. state of *Chaetosphaeria pulchriseta* Hughes, Kendrick & Shoemaker in Hughes and Kendrick, *N. Z. Jl. Bot.* **6**: 356, 1968.

Plate 5, figures 5 - 6.

Colonies effuse, often caespitose, pale grey to black. *Mycelium* immersed in the substrate, composed of branched, septate, sub-hyaline to brown, smooth, 2 - 4 μm wide hyphae. *Setae* arising singly or in groups, usually straight, sometimes slightly flexuous, thick-walled, smooth, up to 13-septate, dark brown, cylindrical, always sterile, up to 160 μm long, tapering acutely from the 8 - 9 μm wide bulbous base to a 2 - 3 μm wide apex, penultimate cell darkly pigmented and terminal cell rarely as dark as that. *Conidiophores* macronematous, mononematous, solitary or sometimes in loose fascicles, around base of setae, simple, erect, straight or slightly flexuous, cylindrical, septate, pale brown to brown, paler towards the apex, smooth, cylindrical, up to 64 μm long, 2 - 4 μm wide. *Conidiogenous cells* monophialidic or frequently polyphialidic, integrated, terminal, proliferating percurrently, 16 x 3 - 4 μm , bearing up to 3 conidiogenous loci, at each of which is a distinct, hyaline to sub-hyaline, flaring, funnel-shaped to cupulate, 3 - 4 μm wide, 2 - 4 μm deep collarete. *Conidia* straight acerose to slightly falcate, more or less symmetrical, aseptate, hyaline, smooth, 25 - 36 μm x 2,5 - 4 μm , tips ending in short (up to 1 μm long) equal in length setulae, multi-guttulate, conidia accumulate in slimy masses on the polyphialide tips.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R C Sinclair, PREM 57156.

The generic name *Dictyochaeta* Spegazinni is considered an earlier name for *Codinaea* Maire (Gamundi *et al.* 1977; Kuthubutheen & Nawawi 1991c, d & e; Hawksworth *et al.* 1995). However, although Arambarri and Cabello (1989) stated that the genus *Dictyochaeta* was well defined (based on their results obtained from a numerical taxonomic study of some phialidic genera) they retained the name *Codinaea* for certain species.

This fungus has been recorded from rotten wood and bark collected in New Zealand and the United States of America (Hughes and Kendrick 1968). Although small differences in conidial dimensions are evident between our specimens and some of the earlier collections, the differences are not significant. Our specimens approach in all respects Hughes and Kendrick's collections i.e. the thick-walled sterile seta with the penultimate cell darker than the terminal cell and the symmetrical, falcate, multi-guttulate conidia with setula at each end.

Dictyosporium heptasporum (Garov.) Damon, *Lloydia*, **15**: 118, 1952.

Plate 5, figures 7 - 10.

Colonies punctiform, black, scattered, velvety. *Mycelium* mostly immersed, composed of branched, septate, brown, smooth, 2 - 5 μm wide hyphae. *Conidiophores* micronematous, mononematous, arising in fascicles, irregularly branched, erect, flexuous, cylindrical, septate, hyaline, smooth. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, hyaline, sub-globose. *Conidia* solitary, dry, acrogenous, cylindrical-clavate (maize-ear), 30 - 50 x 15 - 25 μm , consisting of a sub-hyaline, sub-globose, basal cell, 5 - 7 μm wide, on which up to 7 discrete, vertical, closely appressed arms are inserted in different planes. Arms cylindrical with obtuse, somewhat recurved apices, each arm consisting of up to 11 cells, cells 3 - 4 x 2 - 3 μm , conidia dark brown, smooth.

On bark of dead wood, South Africa, Gauteng Province, Pretoria, Botanical Gardens, May 3, 1994, S. Boshoff, PREM 57157.

This specimen's conidia are smaller than those (63.5 - 86 x 22 - 29 μm) described by Damon (1952). However, Rao and de Hoog (1986) remarked that the circumscription of the species is problematic, as Matsushima (1971, 1980) had described two specimens under this name that greatly differed in the shape and size of the conidia.

The characteristic recurvature of the conidial arms can be clearly observed in our specimen. To our knowledge this is a new record of this species for southern Africa.

Diplocladiella scalaroides Arnaud apud M. B. Ellis, Dematiaceous
Hyphomycetes: 229, 1976.

Plate 5, figures 14 - 16.

Colonies effuse, olive-green to brown, shortly hairy. *Mycelium* mostly immersed in the substratum, composed of branched, septate, smooth, fuscous to pale brown to olive-green, 1,5 - 2 μm wide hyphae. *Conidiophores* macronematous, mononematous, scattered, arising singly or in small groups, simple, geniculate, pale brown, becoming paler towards the tip, smooth, short, 15 - 45 μm long, 3 - 4,5 μm wide. *Conidiogenous cells* polyblastic, integrated, geniculate, sympodial, slightly cicatrized. *Conidia* solitary, smooth, 8-celled, consisting of a main axis with two divergent arms: the main axis consisting of a hyaline basal cell (2,6 μm wide, slightly wider towards the apex, 2 μm long and a pale to mid-brown to slightly olive-green) and an apical cell (5,6 - 8 μm wide and 8 - 10 μm long); divergent arms consisting of 3 cells tapering progressively towards the tip, proximal 2 cells pale to mid-brown, slightly olive-green, paler distally, 5,6 - 8 μm wide, second more distal cell tapering to 2,4 μm , up to 15 μm combined total length, distal cell hyaline, up to 20 μm long, 2 - 4 μm wide, tapering sharply to a less than 1 μm thin appendage.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, PREM 57158.

This distinctive fungus occurs on a variety of substrates such as decaying leaves, bark and seeds and has a widespread occurrence. It has been reported from many parts of the world including Japan (Tubaki 1958, Matsushima 1975), France and Great Britain (Ellis 1976) and Taiwan (Matsushima 1980). Webster *et al.* (1994) recorded conidia of this fungus from foam of South African rivers. Although *D. scalaroides*' characteristic conidia may occur in foam samples (Nawawi 1987), it has been recorded mainly from

terrestrial habitats, suggesting that the conidia in the foam samples may have had a terrestrial origin and may well have been washed into a stream.

Prior descriptions of the conidia are simplified in suggesting that the two arms diverge at 90° on a flat plane, while they are diverging three-dimensionally forming a much more complex structure.

To our knowledge this is a first record of this fungus for southern Africa.

Diplococcium anam. state of *Helminthosphaeria clavariarum* (Tul.) Fuckel [as '*clavariae*'], Symb. mycol.: 166, 1870.

Plate 6, Figures 3 - 6.

Colonies effuse, dark brown, velvety. *Mycelium* partly immersed in the substratum, composed of branched, septate, pale brown, smooth-walled, 2 - 4 µm wide hyphae. *Conidiophores* macronematous, mononematous, arising mostly in groups, branched, erect, straight, cylindrical, brown, smooth, 90 - 150 long, 3 - 5 µm wide. *Conidiogenous cells* polytretic, integrated, terminal, determinate, pale brown, cylindrical. *Conidia* acropleurogenous, sometimes singly, mostly in short chains which are occasionally branched, mostly cylindrical to ellipsoidal, but sometimes slightly dumb-bell-shaped because of a slight constriction at the septum, 1-septate, septum often as a wide black band, pale brown, smooth, 13 - 20(15) µm x 6 - 7 µm.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Du Toit's Kloof, Cape Town side, in deep kloof in wooded area, June 25, 1994, R. C. Sinclair, PREM 57159.

The large conidia of this species (that are never more than 2-celled) and the septum that appears as a wide black band distinguish it from other *Diplococcium* species. Our specimen's conidia are more regularly shaped than those in the drawings of Ellis (1963b). To our knowledge this constitutes a new record for southern Africa.

Diplococcium spicatum Grove, *J. Bot., Lond.*, **23**: 167, 1885.

Plate 6, figures 1 - 2.

Colonies effuse, dark brown, hairy. *Mycelium* partly superficial, partly immersed, composed of branched, septate, brown, smooth, 2 - 4 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in groups, branched, short secondary branches are sometimes formed, erect, straight to flexuous, cylindrical, brown, smooth, up to 400 μm long, 3 - 4 μm wide. Minute pores scattered along the stipe indicate where conidia have been borne. *Conidiogenous cells* polytretic, integrated, terminal, determinate, cylindrical. *Conidia* acropleurogenous, catenate, oblong, rounded at the ends, very pale brown, smooth, 1-septate, 9 - 13 μm x 3 - 4 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R. C. Sinclair, PREM 57160.

The genera *Spadicoides* Hughes and *Diplococcium* Grove show similar conidial ontogeny. In both the short dark conidia develop through minute pores in the wall of the stipe. In *Diplococcium* the conidia are often formed in chains and the conidiophores are branched, whilst in *Spadicoides* the conidia are formed singly and the conidiophores are simple (Ellis 1963b). Sinclair *et al.* (1985) abandoned the presence or absence of branched conidiophores as a diagnostic generic character in *Spadicoides*. They stated that branched conidiophores are taxonomically less important than the catenation of conidia. Thus the catenation of conidia should be the diagnostic character differentiating *Diplococcium* from *Spadicoides*.

To our knowledge, this collection constitutes a new record from southern Africa.

Endophragma biseptata M. B. Ellis, *Mycol. Pap.* **72**: 31, 1959.

Plate 6, figures 7 - 8.

Colonies effuse, dark brown, tufted. *Mycelium* immersed, composed of branched, septate, pale brown to brown, smooth, 2 - 4,5 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, caespitose, straight or flexuous, erect, simple, septate, brown, smooth, cylindrical, up to 210 μm long, 2,5 - 6 μm wide. *Conidiogenous cells* monoblastic, integrated, terminal, sometimes determinate, mostly proliferating percurrently, the wall of the lower part of a conidium may remain attached to the top of the conidiophore forming a cup, the conidiophore then proliferate straight through the cup. *Conidia* acrogenous, obovoid, pale brown, cells unequally coloured, the uppermost cell dark brown, the middle cell brown and the lowermost cell pale brown, 2-septate, 20 - 30 μm x 8,5 - 16 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Elsberg, part of Elsberg Research Station, side of hill, south facing, with conifer the predominant tree species, August 10, 1994, R. C. Sinclair, PREM 57161.

The conidia are 2-septate with cells that are unequally coloured. The uppermost cell is usually dark brown, the middle cell brown and the lowermost cell pale brown. The primary conidia when mature frequently do not come completely detached but are pushed over to one side by the rapidly developing conidiophore and remain adhered to the side of the conidiophore (Ellis 1959).

To our knowledge this is a new record for southern Africa.

Endophragma uniseptata M. B. Ellis, *Mycol. Pap.* 72: 28, 1959.

Plate 6, figures 9 - 14.

Colonies effuse, black, hairy. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 4 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in groups, simple, erect, straight or flexuous, cylindrical, septate, brown, smooth, up to 200 μm long x 4 - 8 μm wide, sometimes swollen at the base to 10 μm wide and attenuated towards the apex to 3 - 4 μm wide, proliferate, the wall of the lower part of a conidium may remain attached to the apex of the conidiophore forming a cup and the conidiophore then proliferates straight through the cup. *Conidiogenous cells* monoblastic, integrated, terminal, percurrent, cylindrical. *Conidia* endogenous, acrogenous, single, obovoid, 1-septate, upper cell dark brown, lower cell pale brown, smooth, 15 - 25 μm long x 13 at the widest part and 2 - 3 μm at the base.

On bark of dead wood, South Africa, Western Cape Province - mountainous area, Worcester, mountain pass, June, 24, 1994, R. C. Sinclair, and coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R. C. Sinclair, PREM 57162.

The conidia of *E. uniseptata* differs from *E. boewei* Crane where the apical cell is always much larger than the basal cell (Crane 1972). The characteristic cup formed by the remnant of the lower part of a conidium that stay attached to the conidiophore (Ellis 1959) has only infrequently been observed in our specimen, but is illustrated in Plate 6, figure 14. To our knowledge this is a new record for southern Africa.

Endophragmiella lignicola Hughes, *N. Z. Jl. Bot.* **17**: 151, 1979.

Plate 6, figures 15 - 16.

Colonies effuse, hairy, pale brown, inconspicuous. *Mycelium* immersed, composed of branched, septate, pale brown hyphae, 3 μm wide. *Conidiophores* macronematous, mononematous, single, erect, straight or flexuous, simple, septate, hyaline to pale brown, smooth, cylindrical, thin-walled, up to 110 μm long and 5 - 6 μm wide. *Conidiogenous cells* monoblastic, integrated, terminal, percurrent, cylindrical. *Conidia* solitary, blastic, terminal, dry, acrogenous, simple, ellipsoidal to obclavate, 2-septate, central cell largest, dark brown, thick-walled, apical cell and basal cell hyaline, apical cell obtuse at its end, basal cell truncate, 21 - 30 x 15 - 18 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Elsberg, on Elsberg Research Station, between pasture and vineyard coursing up side of hill in drainage area, thickly wooded, rough terrain, August 10, 1994, R. C. Sinclair, PREM 57163.

Hughes (1979a) redefined the genus *Endophragmiella* and described two new species. He stated that the branching of conidiophores and conidium septation are considered to have little or no diagnostic value in the genus *Endophragmiella*. He placed greater stress on the rhexolytic conidium secession followed by regular percurrent proliferations arising from the penultimate cell of the conidiophore and the successive proliferations.

This species is widespread in Wales (Hughes 1979a) and the UK (Kirk 1986) and is also known from Argentina (Gamundi *et al.* 1979) and Hungary (Révay 1988).

The present collection's conidia differ slightly from the holotype in being larger than the holotype's 15.5 - 19.5 x 4.3 - 5.4 μm . This difference is not regarded as significant. This is the first record of this species from southern Africa.

Engyodontium parvisporum (Petch) de Hoog, *Persoonia* **10(1)**: 53, 1978.

Plate 6, figures 17 - 19.

Colonies effuse, cream coloured. *Mycelium* mostly superficial, composed of branched, septate, hyaline, thin-walled, 1 - 1,8 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising in a group, simple, sub-erect, straight or flexuous, cylindrical, septate, hyaline, thin-walled, often longer than 200 μm , 1 - 1,5 μm wide. *Conidiogenous cells* straight (rachis), cylindrical, slightly tapering towards the tip, of varying length, 1 μm wide, hyaline, densely denticulated, denticles hair-like, 0,5 - 1 μm long. *Conidia* holoblastic, single, globose to irregularly ellipsoidal, aseptate, hyaline, smooth, thin-walled, 1 - 1,5 x 1 - 1,5 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Klapmuts, low lying area near standing water (small vlei) on the edge of a fallow grape vineyard and cattle and horse pasture, wattle the predominant tree species, June 12, 1994, R. C. Sinclair, PREM 57164.

De Hoog (1978) described the conidiophores as branched and stated that the main characteristic of this species is the rachis, which is cylindrical and slightly flexuous with extremely thin denticles. Conidiophore branching has, however, not been observed in our specimen. The thin cylindrical hyaline rachis with extremely thin denticles has been photographed (Plate 6, figures 17 - 18). The conidia attachment is, however, fragile and most conidia in our specimen are detached. To our knowledge this is a new record for southern Africa.

Haplographium anam. state of *Hyaloscypha dematiicola* (Berk. & Br.) Nannf.,
Trans. Br. Mycol. Soc., **20**: 205, 1936.

Plate 6, figures 20 - 24.

Colonies effuse, dark brown to black, glistening, slimy heads clearly distinguishable. *Mycelium* immersed in the substratum, composed of branched, septate, pale brown to hyaline, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, branched at the apex forming a stipe and a head; stipe erect, straight or slightly flexuous, cylindrical, septate, dark brown except at the apex which is sub-hyaline, smooth, up to 270 μm long, 4 - 7 μm wide, apex and base often inflated up to 9 μm , apex bearing several primary branches which themselves bear secondary branches arranged penicillately (head, commonly 30 x 35 μm). *Conidiogenous cells* polyblastic, discrete, borne at the ends of secondary branches, determinate, cylindrical. *Conidia* aggregated in slimy heads, acropleurogenous, simple, cylindrical, rounded at the ends, hyaline, smooth, aseptate, 2 - 3 x 1, 5 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R C Sinclair, PREM 57165.

The conidia are produced on a penicillate head. The head consist of 2 - 4 tiers of metulae (primary branches producing secondary branches). The primary metulae larger and darker than the secondary metulae. The conidia are borne as buds with a minute isthmus.

This species is widely distributed, however, to our knowledge this is a new record for southern Africa.

Helicoma dennisii M. B. Ellis, *Mycol. Pap.* **87**: 23 - 24, 1963a.

Plate 7, figures 1 - 4.

Colonies effuse, pale brown, hairy. *Mycelium* partly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising in a group, simple, erect, straight or flexuous, cylindrical, septate, brown, smooth, up to 300 μm , 5 - 9 μm wide, sometimes up to 10 μm at the base, 4,5 μm at the hyaline apex. *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, brown, cylindrical, denticulate, denticles hyaline, 1, 5 - 2 μm in diameter. *Conidia* acropleurogenous, single, on 1,8 μm long hyaline pegs, helicoid, 6 μm wide filament tightly coiled 1,25 - 1,5 times (circinate), 3 - 8 indistinct septa that appear late in the maturation of the conidium, hyaline, smooth, varied dimensions, mostly 18 - 25 μm in diameter.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Du Toit's Kloof, Cape Town side, deep kloof in wooded area, June 25, 1994, R. C. Sinclair, PREM 57166.

Goos (1987) proposed terms to distinguish the different forms of helicospores. He proposed "circinate" for conidia coiled 1,25 to 1,75 times ($360^\circ+$).

Goos (1986) reviewed the genus *Helicoma* Corda and divided it into four sections. He placed *H. dennisii* in section *Helicoma* where "conidia are borne acrogenously on small denticles, becoming pleurogenous as a result of continued growth of the conidiophore and the lateral displacement of conidia; basal cell of the conidium tapering to a more or less flattened, slightly thickened, attachment scar". Goos also provided a key to the species per section. This key was used to identify this Du Toit's Kloof specimen as *H. dennisii*. To our knowledge this is a new record for southern Africa.

Helicosporium anam. state of *Tubeufia helicomyces* Höhnelt, Sber. *Akad. Wiss. Wien*, **118**: 1477, 1909.

Plate 7, figures 5 - 7.

Colonies effuse, pale brown to dark brown. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, simple at first, branched at base at maturity, apex setiform, erect, straight or flexuous, cylindrical, base light brown, 4 - 8 μm in diameter, tapering to an apex 1 - 1,5 μm diameter, 150 - 300 μm long. *Conidiogenous cells* monoblastic or more frequently polyblastic, discrete, hyaline, cylindrical, denticulate, denticles cylindrical, 2 x 2 μm , on lower half of conidiophore. *Conidia* solitary, pleurogenous, simple, helicoid, 2 - 4 times coiled in one plane (planate), centric, indistinctly 6 - 12 septate, filament 1,5 - 2 μm wide, hyaline, smooth, conidium 18 - 30(22) μm in diameter.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R. C. Sinclair, PREM 57167.

Conidium ontogeny in most helicosporous Hyphomycetes is holoblastic. The conidium axis usually coils as it extends in length, becoming septate as it does so. At maturity, the conidium is delimited from the conidiogenous cell by a septum. Secession is schizolytic. Variations occur in the type of conidiogenous cells formed, ranging from denticles to inflated cells with multiple conidiogenous loci (Goos 1987).

Goos (1987) also provided a key to the different helicosporous Hyphomycete genera. In terms of Goos' key *Helicosporium* Nees has conidia borne on differentiated conidiophores, conidial filaments thin in proportion to length, septa lacking dark bands, conidia with transverse septa only and simple conidial filaments.

Webster (1951) proved the teleomorph-anamorph connection between *Helicosporium phragmites* and *Tubeufia heliomyces* Höhnel. Linder (1929) provided a key to the species of *Helicosporium*. *H. phragmites* Höhnel is distinguished by its thin (1,5 - 2, 5 µm thick) filaments, coil of conidium more than 10 µm in diameter, conidiophores sparsely branched and fuscous conidia.

The species has previously been reported from South Africa from the Western Cape Province, Philadelphia on leaves and stubble of *Triticum aestivum*, P. W. Crous, September 1992, PREM 51287 (Crous 1993). [see Barr (1980) for synonymy].

Henicospora minor Kirk & Sutton, *Trans. Br. Mycol. Soc.* **75(2)**: 249, 1980.

Plate 8, figures 1 - 2.

Colonies effuse, blackish brown, hairy, inconspicuous. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, hyaline, thin-walled, smooth, septate, 2 - 3 µm wide hyphae. *Conidiophores* micronematous, mononematous, arising singly, simple, erect to recumbent, straight or flexuous, hyaline, smooth, up to 15 µm long, 1 - 2 µm wide. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, cylindrical. *Conidia* acrogenous, solitary, cylindrical, rounded at the apex, tapering slightly towards the base, and abruptly in the rhexolytic cell, mostly 5-distoseptate, pale olivaceous brown, smooth, 25 - 30 µm x 3 - 5 µm, conidium delimiting septum remaining unthickened and lost during secession, next higher septum and septum above thickened, seceding by fracture of the basal cell of the conidium (rhexolytic secession).

On bark of dead wood, South Africa, Mpumalanga, Graskop, Natural Bridge, May 31, 1994, R. C. Sinclair, PREM 57168.

The conidia of *H. minor* closely resemble those of *Sporidesmium parvissimum* Hughes in shape, size, type of septation and degree of septation. However, the secession of the conidia of *S. parvissimum* is schizolytic (Kirk & Sutton 1980). To our knowledge this is a new record for southern Africa.

Heteroconium solaninum (Sacc. & Syd.) M. B. Ellis, More Dematiaceous
Hyphomycetes: 65, 1976.

Plate 8, figures 3 - 9.

Colonies effuse, blackish olive to brown. *Mycelium* superficial, composed of repent, pale olivaceous brown, 2 - 3 μm wide hyphae. *Conidiophores* semi-macronematous, mononematous, branched, straight, brown, smooth, up to 110 μm long, 3 - 5 μm wide, swollen at the base. *Conidiogenous cells* monoblastic, integrated, terminal, cylindrical. *Conidia* in short acropetal chains, sometimes branched, cylindrical, tapered at both ends, 1 - 5(3)-septate, pale olivaceous brown, smooth, 12 - 30 μm x 3 - 5 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, near Muldersvlei, roadside-hillside conifer stand, August 10, 1994, R. C. Sinclair, PREM 57169.

There appears to be indeterminate growth resulting in irregularly defined conidia, i. e. variation in the septation, size and shape of conidia. To our knowledge this is a new record for southern Africa.

Monodictys capensis Sinclair, Boshoff & Eicker, sp. nov., *Mycotaxon* **59**: 359 - 360, 1996.

Plates 13 - 14.

Coloniae effusae, atrobrunneae vel atrae. Mycelium partim superficiale vel plerumque in substrato submersum ex hyphis ramosis, septatis, pallide brunneis vel brunneis, laevibus vel verrucosis, 1,5 - 3 μm crassis compositum. Conidiophora micronemata vel semi-macronemata, mononemata, simplicia, recta vel flexuosa, pallide brunnea vel brunnea, verrucosa, ad 130 μm longa, 3 - 4 μm crassa, cellae infrequenter apicem versus

tumidiores, ad 5 μm crassae. Cellae conidiogenae monoblasticae, in conidiophoris incorporatae, terminales, determinatae, cylindricae, verrucosae, pallide brunneae vel brunneae. Conidia solitaria, acrogena, plerumque obovoidea vel pyriformia vel ellipsoidea vel subglobosa, interdum margine leviter irregulari, atrobrunnea vel atra; quum veterascunt, atrascentia, magis crassiparietina et verrucosiora cum areis irregularibus laevibus apicem versus, muriformiter septata, septa invisibilia quum matura, 30 - 100 μm longa, 17 - 60 μm crassa, interdum una vel pluribus cellis basalibus pallidioribus quam ceteris, interdum tumidis et ad 8 μm latis.

In cultura pura in agaro decocto tuberorum: Coloniae tarde crescentes, atrobrunneae vel atrae, marginibus brevibus tenuiter effusis, centro elevato, duro, compacto, facie inferiore atrobrunnea vel atra. Mycelium ex hyphis superficialibus et immersis, ramosis, septatis, confertim implicates, verrucosissimus, 3 - 5 μm crassis compositum, atrascens et asperascens maturitate et habitu aereo. Cellae conidiophorum frequenter tumidae ad 8 μm crassae, interdum tumidae et ad septa leviter constrictae. Conidia irregularissima, frequenter pallide brunnea, maturitate atrobrunnea vel atra, ad 175 μm longa, 110 μm crassa, cellae basales pallidiores quam ceterae, tumidae ad 8 μm latae, cellae interdum ad septa leviter constrictae. Conidia matura, subinde producentia tumores excrescentes, brunneas, leaves, irregulariter septatis, subglobosa ad 30 μm diameter, margini conidii insidentes.

In lignis emortuis decorticatis, Constantia Neck, Western Cape Province, South Africa, July 2, 1994, R. C. Sinclair, PREM 52106, holotypus.

On the natural substrate: *Colonies* effuse, dark brown to black. *Mycelium* partly superficial to mostly immersed in the substrate, composed of branched, septate, pale brown to brown, smooth to verrucose, 1,5 - 3 μm wide hyphae. *Conidiophores* micronematous to semi-macronematous, mononematous, simple, straight or flexuous, pale brown to brown, verrucose, up to 130 μm long, 3 - 4 μm wide, cells infrequently swollen to 5 μm wide towards the apex. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, cylindrical, verrucose, pale brown to brown. *Conidia* solitary, acrogenous, mostly obovoid but also pyriform to ellipsoid to sub-globose, with slightly irregular

margins, dark-brown to black; becoming darker, thicker-walled, and more verrucose with age, with irregular, smooth-walled areas towards the apex, muriformly septate, septa obscured at maturity, 30 - 100 μm long, 17 - 60 μm wide, sometimes one or more basal cells more pale than the others, sometimes swollen to 8 μm wide.

In pure culture on potato-dextrose agar: *Colonies* slow growing (10 mm in 21 days), dark-brown to black, short margins thinly spreading, centre raised, hard, compact, reverse dark-brown to black. *Mycelium* composed of superficial and immersed, branched, septate, densely interwoven, densely verrucose, 3 - 5 μm wide hyphae, increasing in darkness and roughness with maturity and aerial growth. *Conidiophore* cells often swollen to 8 μm wide, sometimes slightly constricted at the septa. *Conidia* very irregular, often pale brown, dark-brown to black at maturity, up to 175 μm long, 110 μm wide, basal cells paler than the others, swollen to 8 μm wide, cells sometimes slightly constricted at the septa. Mature conidia occasionally developing brown, smooth, irregularly septate, sub-globose growths on the conidium margin, up to 30 μm in diameter.

On dead, decorticated wood in advanced stages of decay; South Africa.

Collections examined: Western Cape region, wooded area near stream on roadside, Constantia Neck Road, Constantia Neck, South Africa, R. C. Sinclair, July 2, 1994, PREM 52106, holotype; in pure culture on potato-dextrose agar, PPRI 5984.

The morphological features which are used to distinguish species in *Monodictys* i.e. conidiophore and conidium size; degree of pigmentation of conidiophore and conidium; and the wall ornamentation of the mycelium, conidiophore and conidium change with respect to the stage of development of the fungus. Rao and de Hoog (1986) suggested that the variability described in *M lepraria* (Berk.) M. B. Ellis is due to the slow developmental process typical for the genus and the different stages of maturity seen. Many authors have addressed this issue by including descriptions of developmental changes: conidia of *M. anaptychiae* (Lindau) D. Hawksw. change from pale brown, thin-walled when young to dark brown, thick-walled with conspicuous, irregular ornamentation when mature (Hawksworth 1975); conidia of *M. fluctuata* (M. P. Tandon

& Bilgrami) M. B. Ellis are at first smooth, later becoming verruculose (Ellis 1976) and conidia of *M. austrina* Tubaki are at first pale brown becoming dark brown to fuscous and rough when mature (Tubaki & Asano 1965). However, a higher degree of pigmentation and verrucosity does not always correspond with increasing maturity in the darkly pigmented, dictyosporous species. In *Coniosporium peziza* (Cooke and Ellis) Mason & S. Hughes the young conidia are rough and the large, apparently mature conidia are almost perfectly smooth (Hughes 1950). We, like Rao and de Hoog (1986), emphasized the description of the mature forms.

Hughes (1958), in the original generic description of *Monodictys* and designation of *M. putredinis* (Wallr.) S. Hughes as the type, did not address ornamentation of either the mycelium or conidiophore wall, but declared that the conidia may have either smooth or verruculose wall texture. Ellis (1976) described the genus as having smooth conidiophore walls, which is the case for many of the members, however, this does not appear in the Latin diagnosis (Hughes 1958) and therefore should not be a precluding characteristic. Thus, the conidiophore wall ornamentation is acceptable in *M. capensis* as well as in *M. abuensis* (Chouhan & Panwar) Vasant Rao & de Hoog, where the conidiogenous cells are smooth or slightly verrucose (Rao & de Hoog 1986) and *M. torulosa* Misra & Srivastava, where the conidiophores are smooth or occasionally verrucose (Misra & Srivastava 1979).

Pigmentation, verrucosity, conidiophore cell size and conidium size and degree of irregularity are increased in artificial culture specimens of *M. capensis*. Constrictions at the septa are also more pronounced. The constrictions may be due to cell volume expansion after cross-wall formation as a result of improved cytoplasm transport through the thallus in artificial culture, which may also be responsible for the general increase in size and intensity of the characteristics mentioned. Matsushima (1975) found the mycelium of *M. nigra* Matsush. to be smooth to verruculose in artificial culture while the entire fungus was smooth on the natural substrate. Ellis (1976) described *M. antiqua* (Corda) S. Hughes with verruculose conidia, whereas Rao & Reddy (1978) named a collection of this fungus which is entirely smooth. Verrucosity in a similar genus, *Pithomyces* Berkeley & Broome, has been used to separate species.

but only under well-defined temperature and nutrient conditions and developmental stage (Marasas & Schumann 1972). In *M. capensis*, verrucosity of the conidiophore is a consistent feature appearing in specimens from artificial culture as well as from the natural substrate (Plate 13, figures 4, 5 and 8). Swelling of the conidiophore cells is rare on the natural substrate, however, the characteristic predominates when the fungus is grown in artificial culture. This brings into question the definitive value of these distinguishing features when it is apparent that growth conditions have an influence. Thus, the full range of characteristics, with emphasis on the obvious distinguishing features, have to be considered when attempting to make a diagnosis. Applying relative importance to specific characteristics must be avoided until relationships between particular anamorph characteristics and the identity of the teleomorph and/or other more important ecological or physiological characteristics can be ascertained.

Monodictys capensis is easily distinguished by conidium size and surface texture as well as the irregularity of conidium shape. Irregular conidium shapes also occur in *M. antiqua*, *M. castaneae* (Wallr.) S. Hughes, *M. fluctuata*, *M. indica* S. M. Singh & Barde, and *M. lepraria*. These species differ from *M. capensis* in that: *M. antiqua* has mostly clavate, obclavate or palmate conidia and conidia and conidiophores are smooth; *M. castaneae* has smaller (maximum length and width, 40 x 25 µm) and thinner-walled conidia (Ellis 1971); *M. fluctuata* has smaller (maximum 40 µm diameter), mostly sub-spherically shaped conidia which are verruculose only at maturity (Ellis 1976); *M. indica* has smaller (maximum length and width, 75 x 65 µm), smooth conidia and the conidia and conidiophores have a greenish blue pigmentation in the cytoplasm (Singh & Barde 1985) and *M. lepraria* has sometimes lobed conidia, the conidia and conidiophores are less pigmented and are smooth (Ellis 1976; Rao & de Hoog 1986). The irregular conidium forms in *M. capensis* are most frequent and exhibit the greatest variability in artificial culture. Other species similar to *M. capensis* are *M. paradoxa* (Corda) S. Hughes and *M. putredinis*. *M. paradoxa* has ellipsoidal, pyriform or sub-spherical conidia occurring in effuse colonies on the natural substrate. The conidia are dark, often with swollen and pale basal cells and frequently constricted at the conidium septa which are all similar to *M. capensis*, however, the conidia of *M. paradoxa* are smooth and much smaller (maximum length and width, 43 x 32 µm) (Ellis 1971; Hughes 1950). *M. putredinis* also has

ellipsoidal, pyriform or sub-spherical conidia but they too are smooth and smaller (maximum length and width, 32 x 25 µm) (Ellis 1976) than *M. capensis*. *M. putredinis* has a variably punctiform to spreading colony habit on the natural substrate as opposed to the effuse nature of *M. capensis*. Other species with conidium shapes similar to *M. capensis* are *M. monilicellularis* Matsush., *M. nigra* Matsush., and *M. bogoriensis* (Penz. & Sacc.) S. Hughes. These species, however, are all sporodochium forming and their conidia differ from the conidia of *M. capensis* in size and wall ornamentation. The conidia of *M. monilicellularis* are smooth and smaller (maximum length and width, 45 x 27 µm) (Matsushima 1975) than those of *M. capensis*; those of *M. nigra* are also smooth and smaller (maximum length and width 37 x 23 µm) (Matsushima 1975) and those of *M. bogoriensis* are slightly more ellipsoidal to ovoid in shape and also wider (23,5 - 53 µm) and shorter (31,5 - 79 µm) (Moore 1959) than those of *M. capensis*.

In pure culture isolates of *M. capensis*, outgrowths on mature conidia are occasionally formed similar to those described for *M. gemmipara* Vasant Rao & de Hoog (Rao & de Hoog 1986). The authors used the term “secondary conidia” to describe the outgrowths, yet gave no indication whether or not they can function as conidia i.e. for growth or dispersal. The nature of these structures in *M. capensis* has, also, not been determined.

Monodictys gemmipara Rao & de Hoog, *Stud. Mycol.* **28**: 16, 1986.

Plate 8, figures 10 - 14.

Colonies effuse, dark blackish brown to black. *Mycelium* immersed, composed of a network of branched and tangled, pale brown, smooth, 1 - 3 µm wide hyphae. *Conidiophores* micronematous, mononematous, short, hyaline. *Conidiogenous cells* discrete, oblong to cylindrical, pale brown, mostly verruculose, 5 - 7 µm. *Conidia* solitary, dry, globose to sub-globose, muriform, dark brown to black when mature, 40 - 70 µm, may form secondary conidia. 13 - 23 µm on the perimeter of the main conidia.

On bark of dead wood, South Africa, Western Cape region, mountainous area, near Muldersvlei, roadside-hillside conifer stand, August 10, 1994, R. C. Sinclair, PREM 57170.

Conidia arising terminally from short, undifferentiated, hyaline hyphal branches, formed as pale brown, globose blown-out ends which gradually darken and develop numerous septa by meristematic growth (Rao & de Hoog 1986).

Solitary, muriform, globose to sub-globose conidia with secondary conidia are characteristic of this fungus. To our knowledge this is a new record for southern Africa.

Nodulisporium radians (Berk.) Deighton, *Trans. Br. Mycol. Soc.* **85(3)**: 391, 1985a.

Plate 8, figures 15 - 18.

Colonies effuse, brown, velvety. *Mycelium* immersed, composed of branched, septate, pale brown, smooth, 2 x 1 µm wide hyphae. *Conidiophores* macronematous, mononematous, not aggregated in synnemata, arising singly from a 12 x 12 µm, sub-globose, pale brown cell that are aggregated in groups of up to 10 cells, branched, erect, straight to flexuous, cylindrical, up to 10-septate, brown at the base becoming paler towards the apex, minutely verruculose, more so at the base, up to 200 µm long x 2, 5 - 4 µm wide. *Conidiogenous cells* polyblastic, integrated, terminal, determinate, arranged penicillately at the apex of conidiophores, originate sympodially, sub-septal, cylindrical to clavate, 11 - 16 x 3 - 4 µm, pale brown to hyaline, minutely verruculose, denticulate, denticles short, fragile. *Conidia* solitary, dry, acropleurogenous, ellipsoidal to cylindrical, aseptate, hyaline, smooth, 4 - 8 µm x 1,5 - 2 µm.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Noordhoek, wooded area on hillside near beach, July 2, 1994, R. C. Sinclair, PREM 57171.

Conidiogenous locus a swollen point with subtending constriction. Conidium ontogeny is retrogressive (blastic).

This species has previously been recorded from Tasmania (Deighton 1985a). To our knowledge this is the first recording of this fungus in southern Africa.

Oidiodendron griseum Robak, apud Melin & Nannf. in *Svenska Skogs För. Tidskr.*, 3/4: 440, 1934.

Plate 9, figures 1 - 2.

Colonies effuse, grey to olivaceous brown. *Mycelium* partly immersed in the substratum, partly superficial, composed of branched, septate, sub-hyaline to pale brown, smooth, 2 μm wide hyphae. *Conidiophores* macronematous, mononematous, solitary or in loose fascicles of a few, erect, straight, branched, with the branches hyaline, forming a stipe and head, stipe cylindrical, pale to dark brown, smooth, up to 100 μm long, 1,5 - 2,5 μm wide. *Conidiogenous cells* integrated, terminal on branches, cylindrical, producing a number of short segments by basipetal septation, the conidia then maturing from the tip back towards the main axis. *Conidia* arthroconidia, catenate, simple, oblong or cylindrical or ellipsoidal, aseptate, smooth, hyaline, 2 - 3,5 μm x 1,5 - 3 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Paarl, Paarl Nature Reserve, mixed conifer wooded hillside, August 10, 1994, R. C. Sinclair, PREM 57172.

Robak (1932), Hughes (1953) and Barron (1962) described the formation of arthrospores in *Oidiodendron* Robak. Robak (1932) stated “the conidiophores commence to divide their single branches into sections almost equally long, which are thereupon rounded off and develop into the same number of spores. This division always begins at the branch apices and continues inward along the branches. New branches form later after others have commenced to develop spores.”

Barron (1962) stated that an interesting feature of development is that the conidiophore heads become increasingly dense with age. As conidia are formed back to the main conidiophore axis, new branches arise from the same point to give a whorled appearance. As maturation continues these new branches themselves segment and form spores.

O. tenuissimum (Peck) Hughes approaches *O. griseum* Robak closely, both culturally and morphologically (Barron 1962). Especially in terms of its conidium size (2 - 4 x 1,5 - 2,5 µm). However, *O. tenuissimum* has narrow connectives between the conidia (causing them to resemble beads on a string). Furthermore, in terms of the key provided by Barron (1962), *O. tenuissimum* has conidia with roughened dark outer walls that are commonly globose to sub-globose. *O. griseum* has hyaline oblong to cylindrical to ellipsoidal conidia.

O. griseum is a fungus that has been isolated from litter, soil and wood pulp in Europe, North America and Trinidad (Ellis 1971). To our knowledge this is the first record of this fungus from southern Africa.

Phaeoisaria clematidis Hughes, *Can. J. Bot.* **36**: 793, 1958.

Plate 9, figures 3 - 6.

Colonies effuse, dark brown to black, hairy. *Mycelium* mostly immersed in the substratum, composed of branched, septate, pale brown to hyaline, smooth, 2 - 4 µm wide hyphae. *Synnemata* erect, straight, cylindrical, up to 300 µm long, 15 - 40 µm wide at the base, 9 - 20 µm wide at the apex, composed of parallel conidiophores. *Conidiophores* macronematous, synnematos, erect, straight, cylindrical, septate, pale brown to brown, smooth, 2 - 2,5 µm wide. *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, pale brown, cylindrical, 10 - 50 µm long, 2 - 4 µm wide, denticulate, denticles numerous, prominent, short. *Conidia* solitary, ellipsoidal to sub-globose, aseptate, hyaline, smooth, dimension 3 - 4 µm x 2 - 3 µm.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Noordhoek, wooded area on hillside near beach, July 2, 1994, R. C. Sinclair, PREM 57173.

This fungus has previously been recorded in South Africa from *Wisteria sinensis* (Sims) Sweet, Waterkloof, Pretoria, Transvaal (now Gauteng), October 1984, C. Roux, PREM 47591 and from dead wood, Golden Gate Highlands National Park, Orange Free State (now Free State), March 1979, R. C. Sinclair, AUAM 2298 (Sinclair 1990).

Pleurothecium recurvatum (Morgan) Höhnelt, *Ber. Deutsch. Bot. Ges.* **37**: 154, 1919.

Plate 9, figures 7 - 11.

Colonies effuse, dark brown, hairy. *Mycelium* mostly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 4 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, simple, erect, straight or slightly flexuous, cylindrical, septate, dark brown, paler towards the apex, smooth, 135 - 270 x 3 - 4 μm . *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, denticulate, denticles 3 - 5 x 2 - 3 μm , branching or forming a helicoid cyme, up to 20 μm long, pale brown to hyaline. *Conidia* solitary, ellipsoid to allantoid, 3-septate, hyaline, smooth, 9 - 13 μm x 3 - 4 μm , guttulate.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tokai Forest, Ladies Mile road, open area near stream, July 2, 1994, R. C. Sinclair, PREM 57174.

This fungus has previously been recorded in southern Africa from dead decorticated wood, Mariepskop, N. E. Transvaal (now Mpumalanga), December 1981, R. C. Sinclair, AUAM 2568 (Sinclair 1990).

Pseudospiropes simplex (Kunze ex Pers.) M. B. Ellis, Dematiaceous
Hyphomycetes: 260, 1971.

Plate 9, figures 12 - 14.

Colonies effuse, brown, velvety. *Mycelium* immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 3,5 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, simple, erect, straight or slightly flexuous, cylindrical, septate, dark brown, paler and thinner walled towards the apex, smooth, up to 110 μm long and 4 - 6 μm wide. *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, cylindrical, bearing slightly protruding, prominent crateriform scars, 1 - 3 μm in diameter. *Conidia* acropleurogenous, single, navicular, 4 - 8 disto - pseudoseptate, pale brown, smooth, 30 - 54 μm x 9 - 15 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R. C. Sinclair, PREM 57175.

This fungus has previously been recorded in southern Africa on a dead twig, Debengeni Forest Reserve, Magoebaskloof, N E Transvaal (now Northern Province), August 1979, R. C. Sinclair, AUAM 2369.

Rhinocladiella anam. state of *Dictyotrichiella mansonii* Schol-Schwarz, *Antonie van Leeuwenhoek* **34**: 119 - 152. 1968.

Plate 9, figures 15 - 18.

Colonies effuse, olivaceous brown, sparse. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown to sub-hyaline, smooth, 2 - 3 μm wide hyphae; when aerial hyphae present, pale brown, hyaline at the fertile tip, 2.5 - 3.5 μm wide. *Conidiophores* semi-macronematous, mononematous, arising laterally from

the aerial hyphae in groups closely appressed to the substrate, erect, straight or flexuous, cylindrical, septate, pale brown to hyaline at the apices, smooth, up to 100 µm long, 3 - 6 µm wide. *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, hyaline, cylindrical, denticulate, denticles short, cylindrical, very slightly raised, numerous. *Conidia* acropleurogenous, single, elliptical to sub-spherical, aseptate, pale brown, smooth, 4 - 6(4) x 2 - 4(3) µm.

On bark of dead wood, South Africa, Western Cape Province, -
mountainous area, Baines Kloof, mountain pass, along road side, June 24, 1994, R. C. Sinclair; and
coastal area, Tokai Forest, Ladies Mile road, open area near stream on roadside, July 2, 1994, R. C. Sinclair PREM 57176.

This species has previously been recorded in South Africa on dead wood, Dullstroom District, Transvaal (now Mpumalanga), April 1983, H. M. Smith, AUAM 2547 (Sinclair 1990).

Our specimens have slightly larger conidia than the specimen described by Sinclair (1990) and the conidium shape also differs slightly in that our specimen's conidia are mostly elliptical to sub-spherical as opposed to the ellipsoid to clavate conidia of the specimen described by Sinclair. The Baines Kloof (mountainous area) specimens also have much less aerial hyphae than the specimens collected from Tokai forest (coastal area), which may possibly be the effect of the environment on the expression of this characteristic.

Rhinocladium pulchrum Hughes & Hol.-Jech., in Hughes, *N. Z. Jl. Bot* **18**: 166, 1980.

Plate 10, figure 1.

Colonies effuse, light rust to dark brown, cottony or velvety. *Mycelium* immersed, composed of branched, irregularly septate, hyaline to pale brown to olivaceous brown, smooth, 6 - 9 µm wide hyphae. *Conidiophores* macronematous, mononematous.

dichotomously branched, straight or flexuous, cylindrical, septate, with short, thick (1 μm x 1 μm) cylindrical denticles, sub-hyaline to olivaceous brown, up to 350 μm long, but usually shorter, 6 - 9 μm wide. *Conidiogenous cells* holoblastic, polyblastic, determinate, integrated, terminal or intercalary, cylindrical, denticulate. *Conidia* solitary, dry, formed on short cylindrical denticles, ellipsoidal to limoniform, papillate at the base, non-septate, smooth, hyaline to olivaceous green, mostly with one clear guttule, 6 - 10 μm x 3 - 5 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Constantia, Constantia Nek road, wooded area near stream on roadside, July 2, 1994, R. C. Sinclair, PREM 57177.

The specimens are in close agreement with the type description provided by Hughes and Holubová-Jechová (Hughes 1980b). It also agrees with collections from Divinópolis, Minas Gerais, Brazil (Furlanetto & Dianese 1996), Surrey, U. K. (Kirk 1986) and Hungary (Révay 1993). This constitutes the first record of this species from southern Africa.

Riessia semiophora Fresenius, *Beiträge zur Mykologie*: 74, 1850-1863.

Plate 10, figures 2 - 4.

Colonies effuse, white. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 4,5 μm wide hyphae bearing clamp connections. *Conidiophores* synnematosus, erect, straight, cylindrical, subulate, up to 480 μm long, 20 - 50 μm wide, composed of parallel, septate, cylindrical, smooth, macronematous, straight, pale brown, smooth, 1 μm wide conidiophores that bear clusters of conidia that are perpendicularly attached to the conidiophores. *Conidiogenous cells* sympodial, integrated, terminal. *Conidia* 4-celled staurospores, globose in outline when observed in polar view, and the four cells radiate in a cruciate manner from a central disk, when viewed from the side, the conidia are distinctly flattened and planar, 9 - 17 μm wide and 3 - 6 μm thick, hyaline, smooth.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Paarl, Paarl Nature Reserve, mixed conifer wooded hillside, August 10, 1994, R. C. Sinclair, PREM 57178.

Goos (1967) recorded the first appearance of this fungus on hardwood. He also was the first to observe the clamp connection bearing hyphae and concluded that *Riessia semiophora* was a dikaryotic basidiomycete. However, he stated that until basidia and basidiospores were recognised in *Riessia semiophora*, the species should be retained in the Deuteromycetes.

The thick-walled, hyaline, four petal flower-like stauro-conidia of this fungus are very distinct. To our knowledge this is a first recording of this fungus in southern Africa.

Selenosporella curvispora MacGarvie, *Scient. Proc. R. Dubl. Soc., Ser. B*, **2(16)**: 153 - 158, 1968.

Plate 10, figures 5 - 6.

Colonies effuse, grey, inconspicuous. *Mycelium* immersed in the substratum. *Conidiophores* macronematous, mononematous, branched, with the branches in verticels, stipe erect, straight or flexuous, septate, pale brown to hyaline, smooth, up to 160 μm long, 3 - 8 μm wide at the base, tapering to 2 - 3 μm at the apex. *Conidiogenous cells* holoblastic, sympodial, denticulate, integrated, terminal, arranged in verticels on stipe, cylindrical, 12 - 18 μm long, 3 - 6 μm wide. *Conidia* simple, aseptate, hyaline, smooth, acerose, 3 - 8 x 1 - 1,5 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Worcester, June, 24, 1994, R. C. Sinclair, PREM 57179.

Uncertainty exists around the nature of the conidiogenous apparatus. It is not clear whether the small denticles on the conidiophores are produced sympodially, holoblastically or if they are phialides (Uecker *et al.* 1978).

In his validation of the genus, MacGarvie (1968) described the conidiogenous apparatus of *S. curvispora* MacGarvie as phialidic. Ellis (1971) agreed with MacGarvie's interpretation. Sutton and Hodges (1977) too, as they described a new species in the genus and gave a key for all the existing species (they described and illustrated the new species' conidiogenous apparatus as phialidic). However, Kirk (1982) disagreed. He stated in his description of a specimen of *S. curvispora* that "it appears that each conidiogenous denticle produces only one conidium and that the process involved is holoblastic."

The conidiogenous loci in our specimen are very small, but it appears as if single conidia are holoblastically produced on the denticulated conidiogenous cells. The conidiogenous apparatus should, however, be studied with the electron microscope to precisely determine the mode of conidiogenesis. To our knowledge this is the first collection of this fungus from southern Africa.

Spadicoides obovata (Cooke & Ellis) Hughes, *Can. J. Bot.*, **36**: 806, 1958.

Plate 10, figures 7 - 9.

Colonies effuse, dark brown, hairy. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, smooth, brown, 3 - 5 μm wide hyphae. *Conidiophores* macronematous, mononematous, arise singly or in groups, simple, erect, straight or flexuous, septate, brown to dark brown, smooth, up to 350 μm long, 3 - 7 μm wide. *Conidiogenous cells* polytretic, integrated, terminal, determinate, cylindrical. *Conidia* acropleurogenous, solitary, 2-septate, brown, smooth, black bands at the septa, obovoid to clavate, 15 - 25 x 8 - 12 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area. Worcester, June 24, 1994, R. C. Sinclair, PREM 57180.

Conidia form singly through small pores in the wall of the upper half of the unbranched conidiophore. Wang (1976) and Wang and Sutton (1982) emphasised the importance of

the absence of branched conidiophores as a diagnostic generic character in *Spadicoides* Hughes. However, Sinclair *et al.* (1985) amended the generic circumscription of the genus and stated that the formation of solitary conidia alone should remain the diagnostic characteristic differentiating *Spadicoides* from *Diplococcium* Grove.

The large, obovoid, 2-septate conidia of this species are very distinctive. To our knowledge this is the first collection of this fungus from southern Africa.

Sporoschisma nigroseptatum Rao & Rao, *Mycopath. Mycol. appl.* **24**: 82, 1964.

Plate 11, figures 1 - 2.

Colonies effuse, black, hairy. *Mycelium* immersed in the substratum, composed of branched, septate, hyaline to pale brown, smooth, 3 μm wide hyphae. *Stroma* pulvinate, pseudoparenchymatic, composed of pale brown isodiametric cells, 6 - 8 μm in diameter. *Capitate hyphae* in groups of up to 6, erect, straight, cylindrical, pale brown, tip of apex hyaline, 90 - 120 x 5 μm , apex swollen up to 9 μm wide surrounded by a hyaline cap. *Conidiophores* macronematous, mononematous, phialidic, arising singly or in groups, simple, erect, straight or slightly flexuous, cylindrical, 1 - 2-septate, dark brown to brown, walls smooth and thick, 180 - 240 μm long and 14 - 16 μm wide just above the base, terminating in a phialide. *Conidiogenous cells* monophialidic, integrated, terminal, determinate, dark brown to brown, sub-cylindrical, 130 - 200 μm long; venter obconical, 30 - 50 x 18 - 26 μm ; collarette cylindrical, 100 - 180 μm long; transition from venter to collarette abrupt, collarette 14 - 18 μm wide. *Conidia* endogenous, catenate, cylindrical with both ends rounded, 5-septate, median cells dark brown, end cells hyaline, smooth-walled, 34 - 45 x 11 - 13 μm .

On bark of dead wood, South Africa, Gauteng, Pretoria, Botanical Gardens, May 4, 1994, S. Boshoff, PREM 57181.

This fungus has previously been collected in southern Africa on dead wood, Dullstroom District, Transvaal (now Mpumalanga), April 1983, H. M. Smith, AUAM. Another

collection has been made from dead wood, Mariepskop, N. E. Transvaal (now Mpumalanga), September 1984, R. C. Sinclair, PREM 48918 (Sinclair 1990).

Stachybotrys chartarum (Ehrenb. ex Link) Hughes, *Can. J. Bot.* **36**: 812, 1958.

Plate 11, figures 3 - 5.

Colonies effuse, black, hairy. *Mycelium* partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly, simple, erect, straight to flexuous, cylindrical, septate, pale brown to dark brown, smooth, up to 140 μm long and 3 μm wide. *Conidiogenous cells* monophialidic, discrete, in groups of 3 to 10 at the apex of each stipe, light brown to dark brown, determinate, ellipsoidal to oblong, no collarette, phialides 10 - 13 μm long, 4 - 6 μm wide. *Conidia* aggregated, acrogenous, spherical to obovoid, aseptate, black, verruculose, 6 - 11 μm x 6 - 9 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, PREM 57182.

This species has previously been recorded from South Africa (Eicker 1974; 1975; 1976a).

Stachybotrys kampalensis Hansford, *Proc. Linn. Soc. Lond.* **155**: 45, 1943.

Plate 11, figures 6 - 9.

Colonies effuse, grey to black, hairy. *Mycelium* immersed, composed of branched, septate, pale brown, smooth 1 - 2,5 μm wide hyphae. *Conidiophores* macronematous, mononematous, erect, flexuous, branched, septate, cylindrical, smooth, hyaline to pale brown, 50 - 90 x 4 μm . *Conidiogenous cells* phialidic, discrete, terminal, determinate, arranged in a verticil of up to 8, obpyriform, pale brown, smooth, 10 - 13 x 4 - 5 μm .

Conidia acrogenous, narrowly ellipsoidal (when young), becoming oblong on maturation, rounded at the ends, aseptate, dark brown to black, coarsely ornamented when mature, 8 - 15 x 6 - 11 μm .

On bark of dead wood, South Africa, Western Cape Province, coastal area, Tygerberg Reserve, Cape Town side, June 16, 1994, R. C. Sinclair, PREM 57183.

The conidiophores are described as simple by the original author (Hansford 1943) and by Ellis (1971), Jong and Davis (1976) and Matsushima (1971; 1975), but the conidiophores of our specimen are frequently branched. We feel this does not alter the taxonomic position of this fungus [vide Sinclair *et al.* (1985) who abandoned the presence or absence of branched conidiophores as a diagnostic generic character in *Spadicoides* Hughes]. To our knowledge this is the first collection of this fungus from southern Africa.

Sympodioplanus Sinclair et Boshoff gen. nov.

[Etymology: L. *planus* – flat, in respect of the **flat**, even appearance of the conidiogenous loci that are sympodially arranged on the conidiophores]

Coloniae effusae, sparsae, brunneae, pilosae, plerumque inconspicuae, albae ubi maturae propter sporas. *Mycelium* plerumque in substrato immersum, ex hyphis ramosis, septatis, hyalinis vel brunneis, laevibus compositum. *Conidiophora* macronemata, mononemata, solitaria vel gregaria, erecta, simplicia, recta vel modice geniculata (plerumque minus quam 45 gradus), septata, brunnea, apicem versus pallidiora, laevia. *Cellae conidiogae* holoblasticae, polyblasticae, in conidiophoris incorporatae, terminales, sympodiales, tenui-parietatae, laeves, in geniculis et apice cicatrices numerosas atque approximatas praebentes. Cicatrices planae, a pariete cellae conidiogae contiguae non prominentes neque incrassatae. *Conidia* solitaria, sicca, elongata, ad basim truncata, hyalina vel pallide brunnea, euseptata, laevia, crassitie parietis crassitie parietis cellae conidiogae simili.

Species typica: *Sympodioplanus capensis* R.C. Sinclair et Boshoff.

Colonies effuse, sparse, brown, hairy, mostly inconspicuous, white when mature due to spores. *Mycelium* mostly immersed in the substrate, composed of branched, septate, hyaline to brown, smooth hyphae. *Conidiophores* macronematous, mononematous, solitary or in groups, erect, simple, straight or moderately geniculate (mostly less than 45 degrees), septate, brown, paler towards the apex, smooth. *Conidiogenous cells* holoblastic, polyblastic, integrated, terminal, sympodial, thin-walled, smooth, bearing multiple, closely approximated scars at the points of geniculation and at the apex. Scars are flat, not protruding from the conidiogenous cell wall and not thickened. *Conidia* solitary, dry, elongated with truncate base, hyaline to pale brown, euseptate, smooth, wall thickness similar to that of the conidiogenous cell wall.

Sympodioplanus capensis R. C Sinclair et Boshoff, sp. nov., *Mycotaxon* **64**: 366 - 368, 1997.

Plate 15.

Coloniae effusae, sparsae, brunneae, pilosae, plerumque inconspicuae, albae ubi maturae propter sporas. *Mycelium* plerumque in substrato immersum, ex hyphis ramosis, septatis, hyalinis vel brunneis, laevibus 1,5 - 2,4 μm crassis compositum. *Conidiophora* macronemata, mononemata, solitaria vel gregaria, erecta, simplicia, recta vel modice geniculata (plerumque minus quam 45 gradus), septata, brunnea, apicem versus pallidiora, laevia, usque ad 65 μm longa, 3 - 4 μm crassa. *Cellae conidiogenae* holoblasticae, polyblasticae, in conidiophoris incorporatae terminalis, sympodiales, tenui-parietatae (usque ad 1 μm), laeves, in geniculis et apice cicatrices numerosas atque approximatas praebentes. Cicatrices planae, a pariete cellae conidiogenae contiguae non prominentes neque incrassatae, 1,5 - 2,2 μm latae. *Conidia* solitaria, sicca, plerumque naviculiformia, ad basim truncata, marginibus interdum, irregularibus, ad apicem rotundata et raro parum attenuate, hyaline vel pallide brunnea, laevia, plerumque tri-, interdum quadri- vel quinque-euseptata, 13 - 16 x 2,5 - 4 μm , tenui-parietata, raro usque ad 19 μm longa.

In lignis emortuis decorticatis, saepe interspersus conidiophoris *Pseudospiropes* sp., in regione naturaliter silvestri prope rivulum, Constantia Neck, Kirstenbosch, Western Cape Province, South Africa, 2 July 1994, R. C. Sinclair, PREM 55315, holotypus.

Colonies effuse, sparse, brown, hairy, often inconspicuous, white when mature due to spores. *Mycelium* mostly immersed in the substrate, composed of branched, septate, hyaline to brown, smooth, 1,5 - 2,4 wide μm hyphae. *Conidiophores* macronematous, mononematous, solitary or in groups, erect, simple, straight or moderately geniculate (mostly less than 45 degrees), septate, brown, paler towards the apex, smooth, up to 65 μm long, 3 - 4 μm wide. *Conidiogenous cells* holoblastic, polyblastic, integrated, terminal, sympodial, thin-walled (up to 1 μm), smooth, bearing multiple, closely approximated scars at the points of geniculation and at the apex. Scars are flat in relation to the adjacent conidiogenous cell wall and not thickened, 1,5 - 2,2 μm wide. *Conidia* solitary, dry, mostly naviculiform with truncate base, margins sometimes irregular, at the apex mostly rounded and rarely slightly attenuate, hyaline to pale brown, smooth, mostly three, sometimes four or five-septate, 13 - 16 x 2,5 - 4 μm , thin-walled, in rare instances up to 19 μm long.

On dead decorticated wood, often interspersed with conidiophores of *Pseudospiropes* sp.; South Africa.

Collections examined: wooded area near stream, Constantia Neck, Kirstenbosch, Western Cape Province, 2 July 1994, R. C. Sinclair, PREM 55315, holotype.

Conidia in *Sympodioplanus* are produced holoblastically and are delimited by a septum early in their formation. They mature by apical and diffuse wall building. *Conidia* secede schizolytically. Conidiogenous cell proliferation and conidia maturation are simultaneous. Conidiogenous cell proliferation occurs sympodially below the most recent conidiogenous locus. The conidiogenous loci are closely approximated in a regular fashion, not darkened and never protuberant. The degree of geniculation of the conidiophore and the prominence of the conidiogenous locus are determined by the precise location of the proliferating region of the conidiogenous cell wall. In

Sympodioplanus, the youngest conidium is formed at the apex of the conidiogenous cell. Proliferation originates (immediately) adjacent (below and to one side) to this locus, thus there is little if any protrusion of the conidiogenous loci from the plane of the conidiogenous cell wall. Wall building seems to be concentrated on fast production of new structures rather than thickening of existing loci. A new conidium initial is subsequently formed on alternating sides of the conidiogenous cell apex. Genuation of the conidiophore is mild. After conidium release a “scar” is barely perceptible. In sympodial genera where cell wall thickening occurs at the conidiogenous locus, conidiogenous cell proliferation occurs some distance from the previous locus where wall material is thinner. Thickened conidiogenous loci often protrude in varying degrees from the plane of the conidiophore wall. In these cases a prominent scar is seen after conidium release as in *Pseudospiropes* (Ellis 1971).

Many morphologically similar specimens of sympodially proliferating anamorphic microfungi are being discovered and it is becoming increasingly difficult to find means to distinguish them. The catenation of conidia in the genera *Polyscytalum* (Riess 1853), *Sympodiella* (Kendrick 1958) and *Parasympodiella* (Ponnappa 1975) distinguishes these genera from the other sympodial genera. *Sympodioplanus* has solitary conidia. *Cylindrosymposium* (Castañeda Ruiz & Kendrick 1990) and *Solosympodiella* (Matsushima 1971) are also distinguished by their solitary conidia. The conidiogenous loci of *Cylindrosymposium* are “flat-topped denticles” and in this way differ markedly from *Sympodioplanus*. The characteristics of the conidiogenous locus in the stromatic genus *Thezogonia* B. Sutton (flat, wide and unthickened) are similarly used to differentiate this genus from *Cercospora* Fresen. and other related genera which have thickened scars (Sutton 1973b). The distinction between *Sympodioplanus* and *Solosympodiella* will be discussed at length further on.

The genus *Subulispora* is named with respect to the “awl-shaped” apex of the conidium easily recognised in the type species, *Sub. procurvata* Tubaki & Yokoyama, and in *Sub. rectilineata* Tubaki & Yokoyama (Tubaki & Yokoyama 1971). *Sub. elegantissima* P. M. Kirk (Kirk 1985), *Sub. argentina* Arambarri & Mengascini (Arambarri *et al.* 1987), *Sub. longirostrata* Nawawi & Kuthubutheen (Nawawi & Kuthubutheen 1987) and *Sub.*

malaysiana (Nawawi & Kuthubutheen 1990). Conidium shape is not generally used as a morphological characteristic to delimit genera, although conidium shape is certainly an integral part of the ontogenetic process. Using the characteristics of conidium shape in the etymology of the genus name, however, does emphasize such a feature and in this case creates a conflict. *Sub. britannica* Sutton (Sutton 1973b), *Sub. africana* (Morgan-Jones, Sinclair & Eicker) P. M. Kirk, *Sub. cylindrospora* P. M. Kirk (Kirk 1985), *Sub. gracilis* (Matsush.) De Hoog (De Hoog 1985), *Sub. hareae* Sutton (Sutton 1978b), *Sub. minima* Kirk (Kirk 1981), and *Sub. variabilis* De Hoog (De Hoog 1985) have all been described with irreverence to the generic etymology. The conidia of these seven species are mostly cylindrical with a rounded or obtuse apex and only in *Sub. britannica* are they referred to as “attenuate towards the apex”. In *Sub. gracilis* conidia are “narrowed towards the rounded apex”. *Sub. minima* was assigned to *Subulispora* “with reservations” by Kirk (Kirk 1981) as its predominant characteristics are monoblastic sympodial conidiogenesis and solitary conidia, yet the conidium shape is distinctly cylindrical and not subulate or even attenuate at the apex.

Nawawi & Kuthubutheen (1990) erroneously stated that *Sub. malaysiana* departs from the generic concept of *Subulispora* because “the conidia are borne on raised rather than flat scars”. *Sub. procurvata*, the type, is depicted as having protuberant conidiogenous loci. *Sub. gracilis* and *Sub. minima* are described as having denticles. Except *Sub. africana* (Morgan Jones *et al.* 1983) and *Sub. cylindrospora* (Kirk 1985), all the other current members of *Subulispora* have moderate to distinctly protuberant conidiogenous loci. In these two taxa, the conidiogenous loci are not raised above the plane of the conidiogenous cell wall. The conidiophores are, however, distinctly geniculate (at least 45 to 90 degrees in some instances), making them very distinct from *Sympodioplanus*. The conidiogenous loci of *Sympodioplanus* are closely approximated, although in a regular fashion, not darkened, and are never protuberant. With respect to conidium characteristics, one can rarely find a slightly attenuate apex. These rare conidia also have a greater number of septa (Plate 15, figure 6c). These characteristics distinguish them as somewhat abnormal. It is important to note that, among the species of *Subulispora* that have conidia with a narrowed apex (*Sub. procurvata*, *Sub. rectilineata*, *Sub. elegantissima*, *Sub. argentina*, *Sub. longistrata* and *Sub. malaysiana*), the

conidiogenous loci are all closely and irregularly clustered and are protuberant. These species form a distinct group within the genus *Subulispora*. It awaits further studies to clarify the true relationships.

The conidiogenous loci in *Catenosubulispora* (Matsushima 1971) are similar to *Subulispora* in shape and arrangement and the conidia are subulate with a long, filiform, attenuate apex. The conidia can bear additional conidiogenous loci both laterally and at their apex. This is not seen in any *Subulispora* species. The conidiogenous scars are also darkened in *Catenosubulispora*.

Solosympodiella is a genus considered as possibly congeneric with *Subulispora* (De Hoog 1985). It was established by Matsushima to accommodate species with sympodially proliferating conidiophores with “wide, flat conidiogenous scars and solitary conidia which are elliptical to clavate with truncate bases” (Matsushima 1971). That the term “flat” is used to describe the nature of the scar itself and not its relation to the plane of the conidiogenous cell wall, is clear when one looks at the descriptions and recordings of the species thus far described. Of all species of *Solosympodiella*, namely *Sol. clavata* Matsush. (Matsushima 1971), *Sol. cylindrospora* Matsush., *Sol. pseudoseptata* Matsush., *Sol. rigidentata* Matsush. (Matsushima 1975), *Sol. palmicola* Matsush. (Matsushima 1980), *Sol. phyllostachidis* Matsush. (Matsushima 1983), *Sol. queenslandica* Matsush. (Matsushima 1989), and *Sol. inaequiseptata* Matsush. (Matsushima 1993), only *Sol. phyllostachidis* has conidiogenous scars that are not raised above the plane of the conidiogenous cell wall. Matsushima (1989) commented that the type, *Sol. clavata*, is “manifestly denticulate”. The conidia of *Sol. phyllostachidis* are cylindrical, attenuate towards the apices with truncate bases and in this respect resemble many of the species classified in *Subulispora*. Both *Solosympodiella* and *Subulispora* are found on decaying leaves, whereas *Sympodioplanus* is found on dead wood. The disposition of *Sol. phyllostachidis* should be reconsidered but only after further investigations have taken place.

Pseudospiropes (Ellis 1971) has expanded from two wood-inhabiting species to a genus including twenty-seven very heterogeneous taxa (Castañeda Ruiz 1987; 1988; De Hoog

& von Arx 1973; Deighton 1985b; Ellis 1971; 1976; Holubová-Jechová 1973; Holubová-Jechová & Mercado Sierra 1986; Hughes 1989; Iturriaga & Korf 1990; Matsushima 1975; 1987; 1989; Morgan-Jones 1977a; 1982; Rai & Rai 1995; Sharma 1980; Sivanesan & Sutton 1985; Sutton 1973a; 1993). Among the taxa, *P. obscurus* Matsush. has been described as having “obscure” conidiogenous scars which are neither pigmented nor protuberant (Matsushima 1983). Although this species also occurs on decaying wood, the nature of the conidiogenous loci which are markedly constricted with respect to the basal region of the conidium, raises doubts about its proper placement in *Pseudospiropes*. Iturriaga and Korf (1990), monographed the Discomycete genus *Strossmayeria* Schulzer and proved the genetic associations of the *Pseudospiropes* anamorphs they cultured. Of the fifteen *Pseudospiropes* anamorphs found, the identification of only three species was verified, namely *P. nodosus* (Wallr.) M. B. Ellis, an anamorph of *S. atriseda* (Saut.) Iturriaga, *P. simplex* (Kunze ex Pers.) M. B. Ellis, an anamorph of *S. basitricha* (Sacc.) Dennis and *P. josserandii* (Bertault) Iturriaga, an anamorph of *S. josserandii* (Grelet) Bertault. The *Pseudospiropes* among which *Sym. capensis* was growing is most similar to the anamorph described, yet unnamed by Iturriaga and Korf (1990) for *S. immarginata* (Pat. & Gaill.) Iturriaga. The relationship of this *Pseudospiropes* with *Sym. capensis* is only speculative and beyond the scope of this study. The anamorphs of *Strossmayeria* have conidiogenous scars that are always darkened and protuberant (however, more so in the “*P. nodosus*-type” and less so in the “*P. simplex*-type”). The conidia are markedly similar in size, shape (being mostly fusiform), and septation (being pseudoseptate). The conidial wall is multi-layered and the surface is always pitted or “poroid” (Iturriaga & Israel 1985). It has been postulated that the generic name *Pseudospiropes* should be reserved for those species with a *Strossmayeria* teleomorph (Iturriaga & Korf 1990).

Percurrent proliferation occurs in some sympodial species. Percurrent proliferation is a recognized feature of *Pseudospiropes* (Iturriaga & Korf 1990). In *P. nodosus* there is a break in a thickened apical area of the conidiogenous cell wall through which proliferative growth occurs. In *Subulispora* it is only described for *Sub. minima* where new growth appears to “slide” through the terminal portion of the conidiogenous cell

where no apparent thickening has occurred. It is questionable whether or not this is a genus delimiting characteristic.

In *Chikaneea* (Sutton 1973a), a monospecific genus, conidia are similar to those of *Sym. capensis*. The differentiation of the genera is demonstrated in the table below:

Table 3 Differentiation of *Chikaneea* and *Sympodioplanus*

Characteristic	<i>Chikaneea</i>	<i>Sympodioplanus</i>
Sympodial proliferation	Present	Present
Conidiogenous scar	Unthickened	Unthickened
Conidiophore colouration	Hyaline	Brown
Conidiogenous loci morphology	Broadly denticulate	Flat, not protuberant
Number of conidiogenous loci	Three or less	Numerous
Catenation of conidia	Sometimes	Never

Single characteristics may never be unequivocally significant at the generic level. It is therefore necessary to create combinations of characteristics, hopefully as simplified as possible, to define the genera. These characteristics may be significant at various taxonomic levels. Their usefulness is in differentiation of the taxa. Problems have arisen when a morphological characteristic was used to define the taxonomic level of a species, i.e. *Subulispora* (vide Table 4). The similarity of the morphological characteristics of the anamorphs of *Strossmayeria* isolated by Iturriaga and Korf (1990) suggests there is a very narrow range of variation within the genus *Pseudospiropes*. The genus definition is therefore very restricted. It is thus imperative that descriptions of new taxa are as thorough as possible so as not to overlook any potential key characteristics that may indicate relatedness and so that one does not preclude new taxa from achieving their proper rank by sequestering particular characteristics as having significance at specific taxonomic levels. These characteristics are used to facilitate diagnoses only. When gene codes that regulate the morphological expressions in anamorphic fungi are identified and their distributions analysed, only then will the correlations between specific characteristics and relatedness be more clearly defined.

Table 4 utilises two characteristics to simplify the distinguishing of *Sympodioplanus* from the other nine genera discussed.

Table 4 Summary of two main features aiding the diagnoses of *Sympodioplanus*

GENUS	CATENATION OF CONIDIA	PROTUBERANT CONIDIOGENOUS LOCI
<i>CATENOSUBULISPORA</i>	YES	YES
<i>CHIKANEEA</i>	YES OR NO	YES
<i>PARASYMPODIELLA</i>	YES	NO
<i>POLYSCYTALUM</i>	YES	YES
<i>SYMPODIELLA</i>	YES	NO
<i>CYLINDROSYMPODIUM</i>	NO	YES
<i>PSEUDOSPIROPES</i>	NO	YES
<i>SOLOSYMPODIELLA</i>	NO	YES
<i>SUBULISPORA</i>	NO	YES
<i>SYMPODIOPLANUS</i>	NO	NO

Taeniolella scripta (Karst.) Hughes, *Can. J. Bot.* **36**: 817, 1958.

Plate 11, figures 10 - 13.

Colonies pulvinate, dark brown. *Mycelium* mostly immersed, composed of branched, septate, brown, smooth, 3 - 5 μm wide hyphae. *Conidiophores* semi-macronematous, mononematous, caespitose, simple, erect, flexuous, cylindrical, dark brown, smooth, short, 7 - 15 μm x 3 - 5 μm . *Conidiogenous cells* monoblastic, integrated, terminal, determinate, brown, cylindrical or doliiform. *Conidia* blastic, single or catenate, cylindrical, rounded at apex, narrowed to a truncate base, 1 - 10-septate, constrictions at septa, some pronounced, others not, brown, smooth, 12 - 65 μm long x 4 - 7 μm wide.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Jonkershoek, wooded area near stream, July 3, 1994, R. C. Sinclair, PREM 57184.

Great variations occur in the conidial shape, size and septation of this fungus. This is supported by the key to the species of *Taeniolella* Hughes provided by Ellis (1976). An explanation for the variation in conidium morphology may be that the conidiogenous loci shift either because the conidiophore lengthens or the conidium chain lengthens. In this specimen it appears as if the conidium chain lengthens and the conidia mature simultaneously.

To our knowledge this constitutes a new record of this fungus from southern Africa.

Tetracoccusporium paxianum Szabó, *Hedwigia*, **44**: 76 - 77, 1905.

Plate 12, figures 1- 6.

Colonies effuse, grey, velvety. *Mycelium* mostly superficial, composed of branched, septate, sub-hyaline to pale brown, 2 - 3 μm wide hyphae. *Conidiophores* semi-macronematous, mononematous, loosely branched, straight or flexuous, pale to olivaceous brown, smooth, up to 40 μm long, 3 - 10 μm wide. *Conidiogenous cells* blastic, integrated, terminal, ampulliform. *Conidia* solitary, acropleurogenous, simple, spherical to sub-spherical, dry, dark brown to black, multi-septate, septa at right-angles to one another (cruciatly), 12 - 30 x 11 - 28 μm , verruculose.

On bark of dead wood, South Africa, Gauteng, Pretoria, Botanical Gardens, May 12, 1994, S. Boshoff, PREM 57185.

On the surface *Tetracoccusporium* Szabó appears similar to *Epicoccum* Link ex Schlecht. However, it is readily distinguished from *Epicoccum* as *Epicoccum*'s conidiophores are closely packed forming sporodochia. The septa of *Epicoccum*'s conidia are also obscured in maturity (Ellis 1971), while the mature conidia of *Tetracoccusporium* are distinctly divided cruciatly by septa at right-angles to one another.

Although this Botanical Gardens specimen has conidial dimensions larger than the limits provided by Szabó (1905), i.e. 12 - 18 x 11 - 13 μm , considering the variability observed in this specimen in the size of its conidia, there should be no doubt about the identity of this

specimen. To our knowledge this is the first collection of this fungus from southern Africa.

Ulocladium tuberculatum Simmons, *Mycologia* **59**: 83-84, 1967.

Plate 12, figure 7.

Colonies effuse, blackish brown to black, velvety. *Mycelium* partly superficial, composed of branched, septate, sub-hyaline to pale brown, 1,5 - 3 μm wide hyphae. *Conidiophores* semi-macronematous, mononematous, simple, straight or flexuous, geniculate, pale to mid-brown, smooth, up to 50 μm long, 4 - 6 μm thick. *Conidiogenous cells* polytretic, integrated, terminal, sympodial, cylindrical, cicatrized. *Conidia* solitary, acropleurogenous, ellipsoidal, dry, dark brown to black, cruciately septate, 12 - 35 x 11 - 40 μm , becoming grossly tuberculated.

On bark of dead wood, South Africa, Western Cape Province, coastal area, Klappmuts, low lying area near standing water (small vlei) on the edge of a fallow grape vineyard and cattle and horse pasture, wattle the dominant tree species, June 12, 1994, R. C. Sinclair, PREM 57186.

Ulocladium is differentiated from *Stemphylium* Wallr. by having geniculate, sympodial conidiophores.

To our knowledge this is the first record of this fungus from southern Africa.

Veronaea indica (Subram.) M. B. Ellis, More Dematiaceous Hyphomycetes: 209, 1976.

Plate 12, figures 8 - 9.

Colonies effuse, brown to blackish brown, hairy. *Mycelium* partly immersed, partly superficial, composed of branched, septate, sub-hyaline to pale brown, 1,5 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, simple, straight or slightly flexuous, sometimes geniculate, brown, smooth, up to 150 μm long, 3- 5 μm thick with small flat scars near the apex. *Conidiogenous cells* polyblastic, integrated, sympodial, cylindrical, cicatrized. *Conidia* solitary, dry, acropleurogenous, simple, spherical or sub-spherical with a slightly protuberant truncate base, pale brown, minutely verrucose, 5 - 7,5 μm .

On bark of dead wood, South Africa, Western Cape region, mountainous area, Elsenberg, part of Elsenberg Research Station, side of hill, south facing, with conifer the predominant tree species, August 10, 1994, R. C. Sinclair, PREM 57187.

Ellis (1976) redescribed *V. indica*. He placed *Chloridium indicum* Subramanian, described in 1955, in synonymy with *V. indica*. Our specimen has conidial dimensions and morphology which agree with the limits and key provided by Ellis (1976). To our knowledge this constitutes a new record for southern Africa.

Virgariella atra Hughes, *Can. J. Bot.*, **31**: 654, 1953.

Plate 12, figures 10 - 13.

Colonies effuse, dark brown, hairy. *Mycelium* partly superficial, mostly immersed in the substratum, composed of branched, septate, pale brown to hyaline, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in groups.

simple, erect, straight or flexuous, geniculate, cylindrical, septate, pale brown to hyaline at the apices, smooth, up to 360 μm long, 5 - 8 μm wide. *Conidiogenous cells* polyblastic, integrated, terminal, determinate, hyaline, cylindrical. *Conidia* endogenous, acropleurogenous, single, globose to sub-globose, aseptate, pale brown, smooth, 11 -16 μm x 9 - 14 μm .

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Elsberg, part of Elsberg Research Station, side of hill, south facing, with conifer the predominant tree species, August 10, 1994, R. C. Sinclair, PREM 57188.

Our specimen's conidium shape and other features compare well with the type description by Hughes (1953). Lunghini and Rambelli (1978) collected this species from the rainforest of Tai, National Park in the Ivory Coast. To our knowledge this is a new record for southern Africa.

Virgariella sphaerica Matsushima, Icon. Microfung. Mat. Lect.: **96**, 1975.

Plate 12, figures 14 - 16.

Colonies effuse, dark brown, thick, velvety. *Mycelium* partly superficial, mostly immersed in the substratum, composed of branched, septate, pale brown to hyaline, smooth, 2 - 3 μm wide hyphae. *Conidiophores* macronematous, mononematous, arising singly or in groups, simple, erect, straight or flexuous, occasionally geniculated below the conidiogenous region, cylindrical, septate, pale brown to hyaline at the apices, smooth, up to 75 μm long, 4 - 4,5 μm wide. *Conidiogenous cells* polyblastic, integrated, terminal, determinate, hyaline, cylindrical, cicatrized, scars not protuberant. *Conidia* endogenous, acropleurogenous, single, globose, aseptate, pale brown, smooth to minutely verrucose, 4 - 6 μm in diameter.

On bark of dead wood, South Africa, Western Cape Province, mountainous area, Baines Kloof, mountain pass, along road side, June 24, 1994, R. C. Sinclair PREM 57189.

Kirk (1981b) mentioned that this species appears to be incorrectly placed in *Virgariella* Hughes as the other *Virgariella spp* have persistent cylindrical denticles while *Virgariella sphaerica* has slightly raised thickened scars. Raised scars are not observed in our specimen. Furthermore, single characteristics may never be unequivocally significant at the generic level (Sinclair *et al.* 1997). To our knowledge this is a new record for southern Africa.

DISCUSSION

Assignment, grouping and classification of Hyphomycetes is difficult and laborious.

Inherent difficulties are, amongst others, their microscopic size (one has to push the light microscope to the limits of its resolution and even bring the electron microscope to bear), their frequent lack of a sexual state, their simple morphology, yet complex (and plastic) modes of spore formation and secession, the interdependence of many characteristics, the effect of the environment on the expression of these characteristics (e.g. the relationship between cultural conditions and conidial ontogeny - Kohn 1992, stated that factors in the environment which vary over a short period have an effect on the phenotypic variability of these characteristics; that is, variability that is environmentally triggered and which occurs over a short span of time, i.e. the life of one thallus) and type descriptions that are antiquated and incomplete (it is impracticable to think that descriptions dating from the seventeenth century, conceived over a span of three centuries and in the minds of hundreds of different authors could have foreseen all the variations/spectrum discovered and described up till now).

Furthermore, notwithstanding an unrelenting search for new methods of differentiating Hyphomycetes (which has been continuing over the centuries - morphological characteristics described in 1729 are still used in the classification of Hyphomycetes) in an effort to shed light on their phylogeny, the classification of these fungi is still almost solely based on the morphological characters of the asexual conidial stage (anamorph).

Recently results obtained from r-DNA studies (Yan *et al.* 1995; Crous *et al.* 1997, Coetsee *et al.* 2000) demonstrate the value of traditional morphology. These can now be enhanced by integrating molecular techniques with traditional morphology to assess morphological variation accurately, and also to confirm anamorph and teleomorph relationships. However, although molecular studies answer critical questions of phylogenetic relationships, anamorphs and teleomorphs mostly develop and occur under

different evolutionary pressures, at different times, and serve different purposes; therefore each may change independently of the other, which leaves a number of unanswered questions that should form the link between phylogenetic and ecological relationships.

The present study also used morphological characteristics of the anamorphs of these fungi, i.e. the type of conidiogenesis and other features connected with or resulting from the development of conidia and their secession, to classify the collected specimens as the form in which these fungi most commonly manifest themselves as in the conidial state.

However, it is stressed that single characteristics should never be used to define a taxon, but rather a combination of characters as problems have arisen when a single morphological characteristic was used to define the taxonomic level of a species (i. e. *Subulispora* Tubaki). It is therefore necessary to create combinations of characteristics, as simplified as possible, to define genera. These characteristics may also be significant at other taxonomic levels, i. e. species. Their usefulness is in differentiation of the taxa. It is thus imperative that descriptions of new taxa should be as thorough as possible so as not to overlook any potential key characteristics that may facilitate diagnoses.

When gene codes that regulate the morphological expressions in anamorphic fungi are identified and their distributions analysed, only then will the correlations between specific characteristics and relatedness be more clearly defined.

Although this research may appear critical of past attempts at creating a workable system, there are hypotheses about relatedness intrinsic to the existing taxonomic system that, along with the characters that originally shaped them, must be considered, reviewed and compared. Attempts must be made to answer important basic questions such as: "What is a species? What kinds and amounts of variability exist within and between species? What time frame and physical and biological forces contribute to the evolution, maintenance and extinction of species? What is the rate of genetic drift and stability of gene frequencies? Is a species the appropriate level within the genealogical hierarchy to examine the multitude of interactions between fungal saprotrophs, parasites, pathogens,

hosts and physical environments? Are the characteristics that we use to differentiate at the generic and specific level properly weighted?" (Morton 1990).

To answer the above questions research by physiologists and biochemists should be used to enable morphologists to determine which morphological characters are the useful/important characters when determining taxonomic levels of relatedness.

However, there is currently an ever increasing and immense mismatch between human resources and the knowledge gap. It is estimated that the number of undescribed Ascomycetes may be as high as 62 000 genera and 669 000 species and the World's entire systematic mycological workforce currently describes around 1 700 species each year. Thus, it may take 390 years to document these fungi!

This is not an issue peculiar to fungi, but rather to the field of systematics as a whole (Janzen 1993). Thus, existing systematic resources must be more effectively deployed [i. e. the author's literature database in INMAGIC PLUS, where each of the 700 references is stored in terms of fields such as author, title, publishing date, publication, key (genera and species) and notes (comments/observations on any related aspect). Searches can be done on any one of these fields. Funding bodies must be made aware of the relevance and importance of the subject (to entice new talent to the subject and extend the cadre of systematists) and systematists should support each other.

CONCLUSION

Although the weakness of the morphology-based taxonomy approach has been emphasised and many methods of determining fungal relationships now exist, in my opinion morphology-based taxonomy will continue to be used in Hyphomycete identification because it is practical and easily applicable (it meets the need of the users by providing a reference framework).

From the results obtained in this study, it is apparent that more morphology-based Hyphomycete studies with regard to southern African habitats are needed. This is confirmed by the first paper of a series of Partridge *et al.* (1999) on collections made from southern Africa. They described two new taxa based on certain monothetic hallmark morphological characteristics of the genera the two taxa belong to. Furthermore, the large number of new taxa collected in this study is indicative of how incompletely microfungi have been collected in the past (Hawksworth 1991).

However, although recent results obtained by r-DNA studies demonstrate the value of morphology, these studies point the way to more intensive research by way of modern techniques to throw more light on processes which we do not understand at present. No doubt new techniques will help us to better understand the relationship between fungi.

SUMMARY

From May 1994 until the end of August 1994, pieces of decomposing wood and twigs were collected from different locations in the Northern Cape Province, Gauteng, Mpumalanga and in the Western Cape. Fifty-nine taxa were recorded (one new genus, one new species and 43 new records from southern Africa).

This study reviews the development of the taxonomy of the mitosporic fungi, in particular the Hyphomycetes, makes some comments on the structure-function relationships and functional diversity that occur and describes a large number of new Hyphomycete records for southern Africa.

The classification of these microfungi has been controversial since inception. As the asexual phase of a sexually reproducing organism (the ascomycete or basidiomycete states), the taxonomy is covered by a dualistic nomenclature which is an exception of Principle IV (one organism: one name) of the International Code of Botanical Nomenclature (ICBN). Although the role of morphological features in the development of anamorph taxonomic theory has evolved as microscopic image technology has advanced, inadequately defined characters, obscure distinctions between morphologically similar species and a weak theoretical base undermine the usefulness of this system. Molecular systematic studies are yielding a wealth of new fungal taxonomic characters. Molecular technology can generate the data required to verify phylogenetic relationships in this artificial classification system, but is subject to the constraints of time, money and expertise. Neither morphological nor molecular based taxonomy is inherently superior. The utilitarian aspect of morphological systematics, in fact, is the great advantage over molecular methods. However, from the viewpoint of applied mycology, the biochemical profiles of these organisms offer the most useful identification system. The taxonomic significance of the results from such investigations and their contribution to a better understanding of the complex situation are undeniable.

All earlier views and systems were based on the knowledge and technology available at that time. Current students of this group can similarly only base their views and proposals on the information available. Current knowledge is advanced to what was known then. This will also be true about today's concepts and those still to come. The now redundant systems were created to serve science and not because of human inadequacies. The nature of these fungi dictates to scientists an arbitrary species concept and user-friendly taxonomic systems. Various opinions about terms, and especially the conidiogenic processes, appear to be confusing, but led to a functional, although phylogenetically inadequate, system. What *Kananaskis* could not do for phylogenetics, it did for standardisation of terms.

OPSOMMING

Vanaf Mei 1994 tot die einde van Augustus 1994 is stukke verrottende hout en takkies op verskeie plekke in die Noord Kaap Provinsie, Gauteng, Mpumalanga en die Wes-Kaap Provinsie versamel. Nege en vyftig taxa is beskryf (een nuwe genus, een nuwe spesie en 43 nuwe beskrywings vir suidelike Afrika).

In hierdie studie word 'n oorsig van die ontwikkeling van die taksonomie van die mitosporiese fungi, in besonder die Hyphomycetes, gegee, word kommentaar oor die ekologie van dié fungi gelever, en word 'n groot aantal nuwe beskrywings van Hyphomycetes in suidelike Afrika gegee.

Die klassifikasie van dié mikrofungi was van die begin af omstrede. As die ongeslagtelike fase (die ascomycete of basidiomycete stadiums) van 'n organisme wat geslagtelik voortplant, bestaan die taksonomie uit dubbele naamgewing, wat 'n uitsondering op beginsel IV (een organisme; een naam) van die Internasionale Kode van Plantkundige Naamgewing (IKPN) is. Alhoewel die rol van morfologiese kenmerke in die ontwikkeling van anamorfe taksonomiese teorie ontvou het namate mikroskopiese beeldtegnologie ontwikkel het, word die bruikbaarheid van die stelsel ondermyn deur onvoldoende omskryfde kenmerke, vae onderskeiding tussen morfologies soortgelyke spesies en 'n swak teoretiese basis. Molekulêre sistematiese studies voorsien 'n oorvloed van nuwe taksonomiese kenmerke ten opsigte van fungi. Molekulêre tegnologie kan die data wat benodig word vir die verifiëring van phylogenetiese verhoudings in hierdie kunsmatige klassifikasiestelsel, lewer, maar dit is onderhewig aan die beperkings van tyd, geld en kundigheid. Nóg morfologies- nóg molekulêr-gebaseerde taksonomie is inherent meerderwaardig. Die nutsaspek van morfologiese sistematiek is trouens die groot voordeel bo molekulêre metodes. Uit die oogpunt van die toegepaste mikologie, egter, bied die biochemiese profiele van dié organismes die bruikbaarste identifikaasiesistelsel. Die taksonomiese betekenis van die resultate van sodanige ondersoeke en hulle bydrae tot 'n beter begrip van dié ingewikkelde situasie is onbetwisbaar.

Alle vroeëre sienings en stelsels was op die kennis en die tegnologie wat destyds beskikbaar was, gebaseer. Hedendaagse studente van dié groep kan insgelyks hulle sieninge en voorstelle slegs op die beskikbare inligting baseer. Huidige inligting is gevorderd in vergelyking met dit wat destyds bekend was. Dit sal ook geld vir die moderne konsepte en dié wat nog moet kom. Die stelsels wat nou verouderd is, is geskep om die wetenskap te dien en nie as gevolg van menslike gebreke nie. Die aard van hierdie fungi verplig wetenskaplikes tot 'n arbitrêre beeld van die spesies en verbruikersvriendelike taksonomiese stelsels. Verskillende menings oor terme, en veral die konidiogeniese prosesse, kom verwarrend voor, maar het aanleiding gegee tot 'n funksionele hoewel phylogeties gebrekkige stelsel. Wat *Kananaskis* nie vir phylogetika kon doen nie, het dit vir die standaardisering van terme gedoen.

ACKNOWLEDGEMENTS

I acknowledge above all God's love, mercy and kindness for providing me with the support structure (family, friends and colleagues), health, and tenacity to keep on trying. Charles Kettering's words have been constantly in my thoughts: "*Virtually nothing comes out right the first time. Failures, repeated failures, are signs on the road to achievement. The only time you don't fail is the last time you try something, and it works. One fails forward towards success.*"

I express my sincere thanks and appreciation to my supervisors Professor Albert Eicker and Dr Robert Sinclair for constant encouragement, support, advice and assistance. I am particularly much indebted to Dr Sinclair for sharing his vast experience in the field with me.

I thank my husband, children, parents, friends and colleagues for their unselfish support and encouragement.

I dedicate this to Eben, Etienne and Adri - although I have tried to express my appreciation and gratitude for your never-ending love, emotional support and belief in me, it can never compensate for all the hardship you had to endure because of my studies.

PHOTOGRAPHIC PLATES

Plate 1

Acrodictys deightonii M. B. Ellis:

1. sporulating fungus on natural substrate.
2. barrel-shaped percurrent proliferation of conidiogenous cell with immature conidium.
3. mature conidium on conidiophore.
4. released conidium with protruding peripheral cells and extending germ tube initials.

Acrodictys globulosa (Tóth) M. B. Ellis:

5. conidiophores arising singly or in groups of 2 - 3.
6. developing conidium with 3 indistinct transverse and two indistinct longitudinal septa
7. mature conidium with increased pigmentation and septation less clear.
- 8 - 9. conidiophores demonstrating proliferations.

Acrogenospora sphaerocephala (Berk. & Br.) M. B. Ellis:

10. sporulating fungus on substrate.
11. group of conidiophores with proliferation "scars".
- 12 - 14. globose conidia with truncate detachment point indicated by the arrows.

Actinocladium rhodosporum Ehrenb.:

15. developing conidium on conidiophore that terminates in a series of up to three more or less barrel-shaped proliferations, the constrictions (indicated by the arrows) representing former conidial scars through which the conidiophore has proliferated.

Alternaria alternata (Fr.) Keissler:

- 16 - 18. conidia in branched chains.
- 19 - 20. mature conidia with surface ornamentation.



PLATE 1

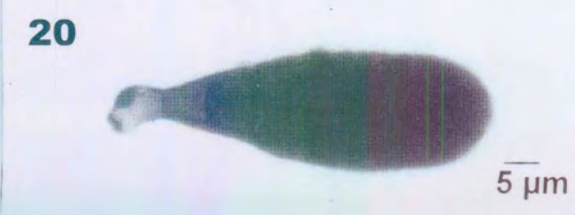
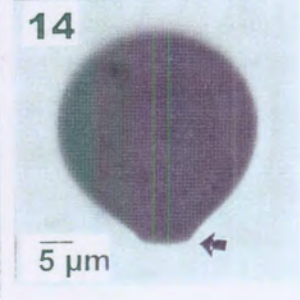
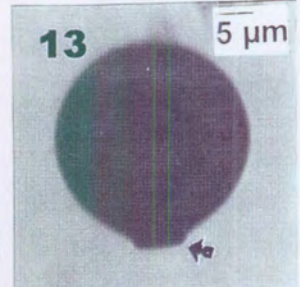
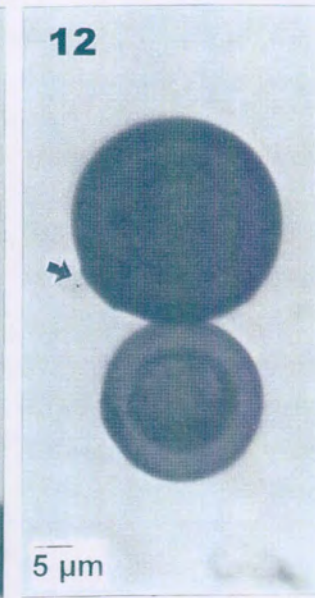
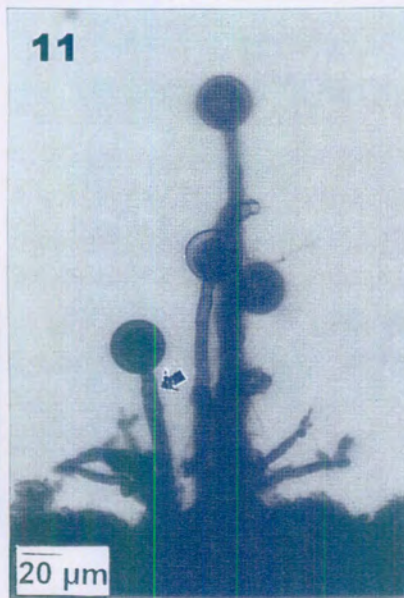
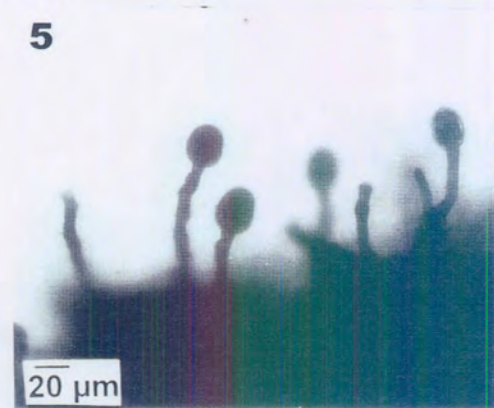


Plate 2

Alysidiopsis pipsissewae Sutton:

1. sporulating fungus on natural substrate.
- 2 - 3. conidiophores branching below a septum (arrow).
- 4A - 4C. conidiogenous cells detached from conidiophores.
- 4D. “*Cladosporium*-like” conidiogenous cell (i.e polyblastic, variable in size and shape, often with distinctly protuberant scars) with ellipsoidal conidia giving rise to sub-sphaerical conidia.
5. conidia in branched chains, frequently with protruding truncate denticles.

Balanium stygium Wallroth:

- 6 - 7. dark brown conidia still attached to conidiophore, separating cell clearly visible.
8. conidiophore terminus with rhexolytic “scars”.

Bispora betulina (Corda) Hughes:

9. catenate conidia, occasionally 2- or more septate.
10. short, erect conidiophore.

Brachydesmiella biseptata Arnaud ex Hughes:

11. sporulation on natural substrate.
12. scar with brownish peripheral zones, arrow indicates most recent conidial release.
- 13A - 13C. most common symmetrical conidia, 2-septate with large central and echinulate end cells.
- 13D - 13E. eccentric bulging of central cell in some conidia.
- 13F - 13H. less common conidia devoid of pale terminal cell.



PLATE 2

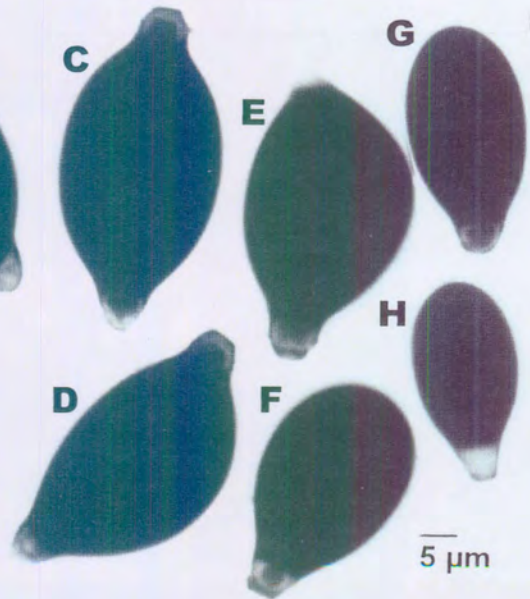
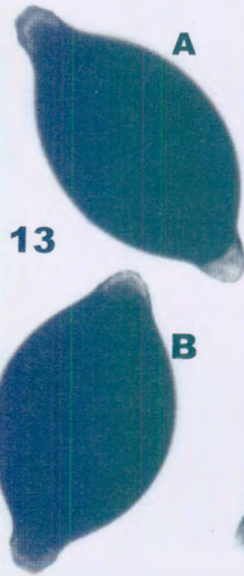
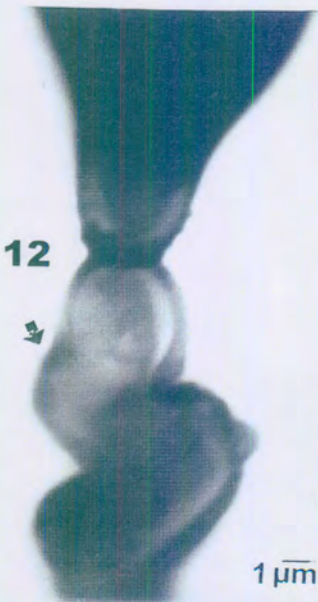
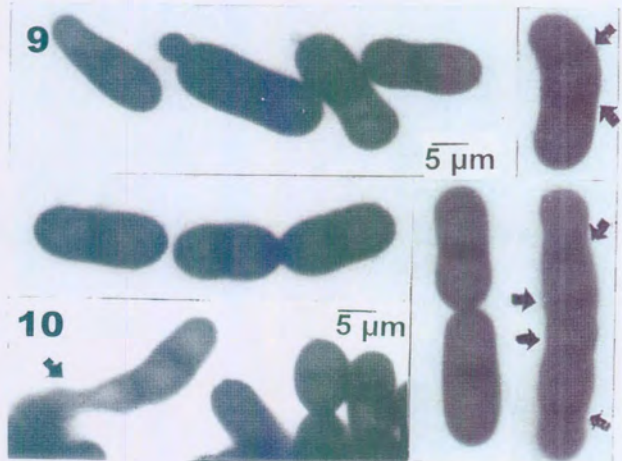
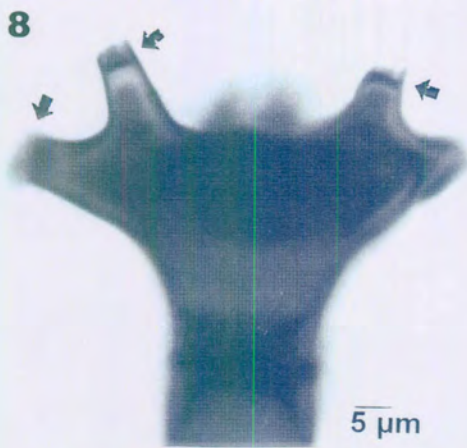
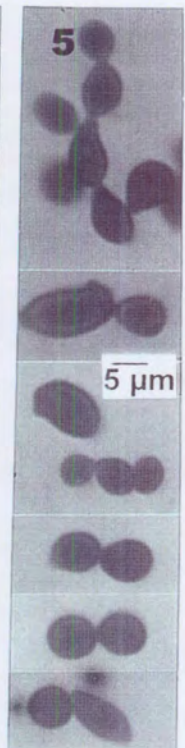
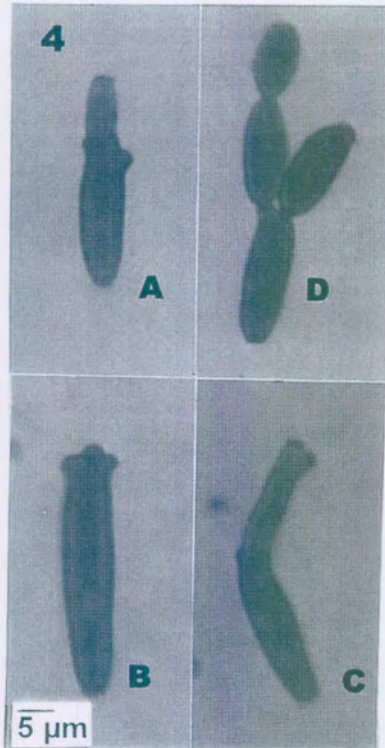
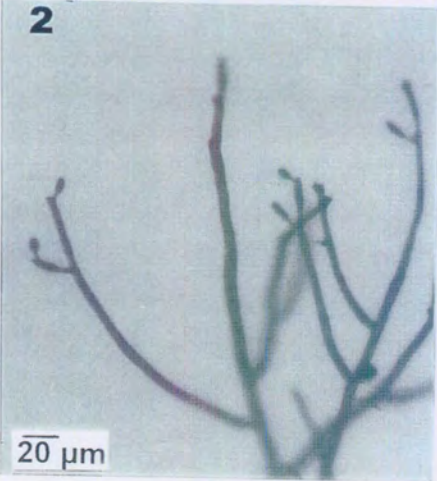


Plate 3

Brachysporiella gayana Batista:

1. sporulating on natural substrate.
2. tip of mature conidiophore has a beaded appearance because of the proliferation of the lageniform conidiogenous cells (arrows).

Brachysporium bloxami (Cooke) Sacc.:

3. 3-septate conidium attached to conidiophore with long cylindrical pedicel (arrow).
- 4 - 5. polyblastic conidiogenous cells.
6. typical conidium.
7. atypical conidium.

Camposporium antennatum Harkness:

8. appendiculated conidium.
9. conidiogenous cell with long cylindrical denticle which functions as a separating cell

Catenularia anam. state of *Chaetosphaeria innumera* Tul.:

10. the conidiogenous cell appears denticulate as the conidium attachment to the cytoplasm within the thickened outer wall (arrow) of the conidiogenous cell appears to have everted.
- 11 - 12. typical appearance of endogenous conidia in a slimy group at the tip of the conidiogenous cell.

Chalara aurea (Corda) Hughes:

13. long conidiophore stipe, conidiogenous cell lageniform
- 14 - 15. conidia catenate, 1-septate.

Chalara hughesii Nag Raj & Kendrick:

- 16 - 18. *Chalara hughesii* differs from *Chalara aurea* mainly in its lack of a long conidiophore stipe.



PLATE 3

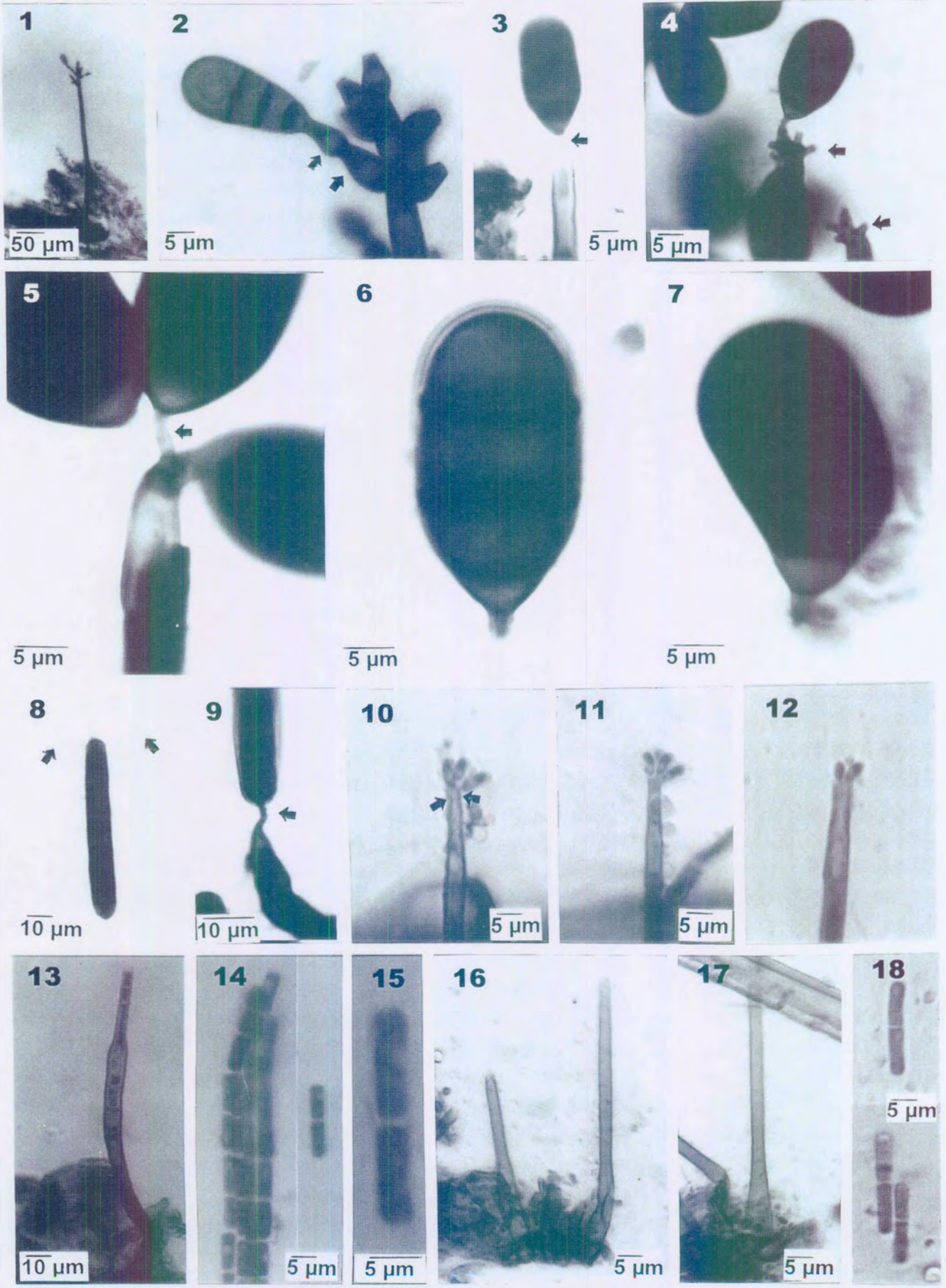


Plate 4

Chalara inflatipes (Preuss) Sacc.:

1. sporulation on natural substrate.
2. multiseptate conidia (mostly 7-septate).

Chloridium clavaeforme (Preuss) Gams & Hol.-Jech.:

3. collarette flaring, more or less cylindrical, slightly wider than deep, conidia cuneate to triangular.

Chloridium smithii Sinclair & Eicker, :

4. arrows indicate diagnostic collarette remnants on conidiophore.

Chloridium transvaalense Morgan-Jones, Sinclair & Eicker:

5. sporulation on natural substrate.
- 6 - 7. multiple phialides appearing in a verticillate arrangement.
- 8 - 9. flask-shaped phialide with an abruptly flaring collarette, conidia aseptate.

Coniosporium anam. state of *Hysterium insidens* Schw.:

10. oblong to cylindrical conidium, rounded at the ends.
11. conidia in chain, arrow indicates link point of two conidia in a chain.
12. conidium still attached to conidiogenous cell.
- 13 - 14. scanning electron micrographs illustrating the irregular nature of the wall material deposits.



PLATE 4

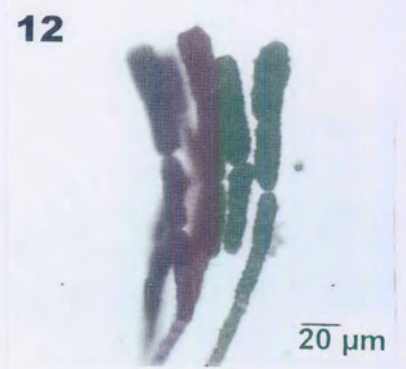
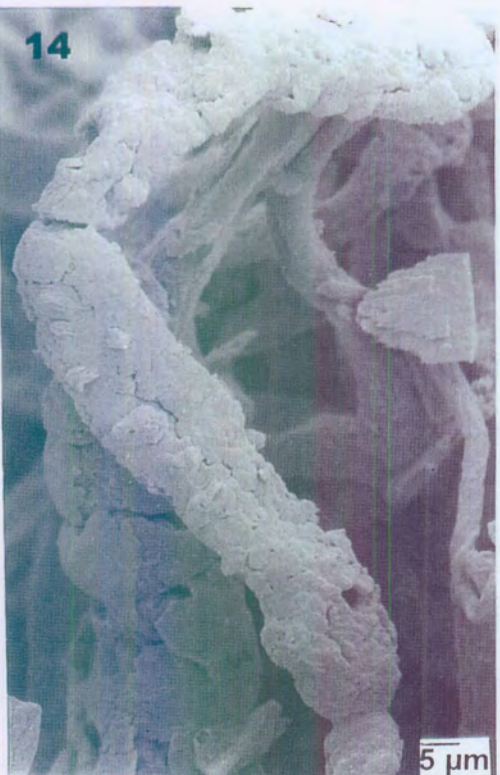
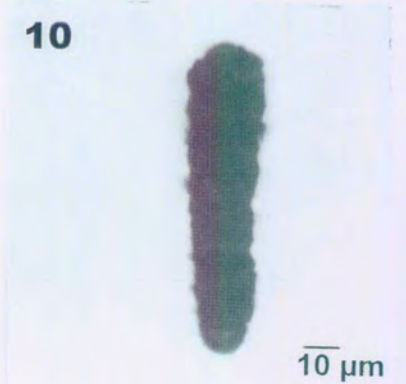
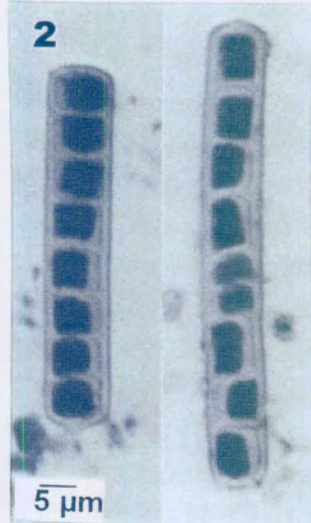


Plate 5

Cylindrotrichum probosciophorum (DiCosmo, Berch & Kendrick)
Arambarri & Cabello:

1. conidiophore with conidia still attached to tubular fertile extension of conidiogenous cell.
2. cylindrical 1-septate conidia.

Dendryphiopsis anam. state of *Amphisphaeria incrustans* Ellis & Everh.:

3. branched conidiophore, conidia already detached.

4. conidia with 4 or more transverse septa. The top conidium is a typical conidium, while the other illustrate the differences that occur, i.e. slightly curved conidia, inconsistent mild constrictions at the septa and the unequal width of some of the cells of a conidium that change the cylindrical shape of the conidium to something more “beaded”. Arrows indicate detachment point.

Dicranidion fragile Harkness:

11. sporulation on natural substrate, conidiophore slightly ampulliform bearing bilobate conidium on thin denticle (arrow).
- 12 - 13. bilobate conidia.

Dictyochaeta anam. state of *Chaetosphaeria pulchriseta* Hughes, Kendrick & Shoemaker:

5. a new growing point arises just below the phialophore apex, proliferation occurs and a narrow neck and collarete are formed at the new apex, the original collarete being displaced to one side. Up to 3 successive proliferations are produced and the polyphialide bears the persistent remains of the funnel-shaped to cupulate collarettes.
6. slightly falcate conidia with short setula at each end.

Dictyosporium heptasporum (Garov.) Damon:

- 7 - 10. maturation of conidia, this species is usually distinguished by the distinct “hook” at the distal ends of the vertical arms of mature conidia and the ease with which the arms separate as the spore mature.

Diplocladiella scalaroides Arnaud apud M. B. Ellis:

- 14 - 15. conidiophore, sympodially proliferating, cicatrized (arrow) conidiogenous cells bearing stauriform conidium.
16. conidium with thin hyaline appendages (arrows).



PLATE 5

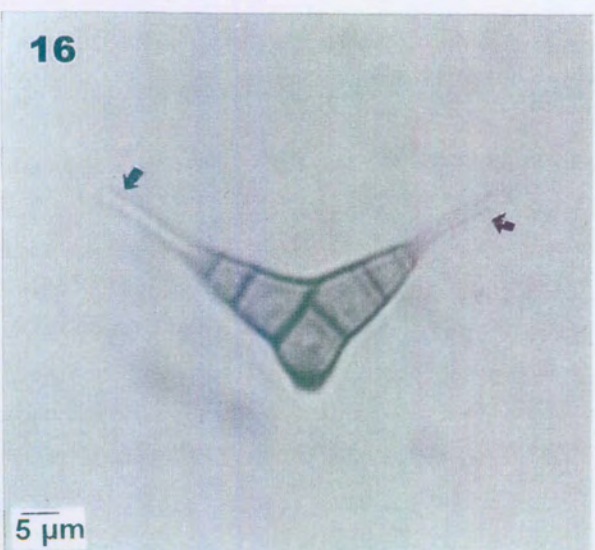
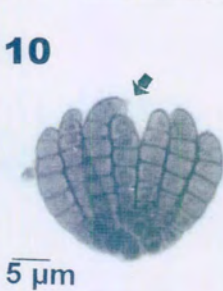
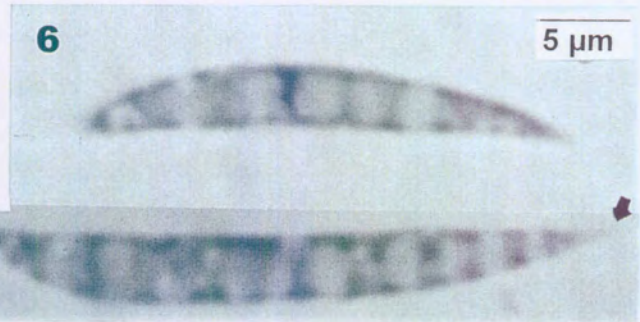
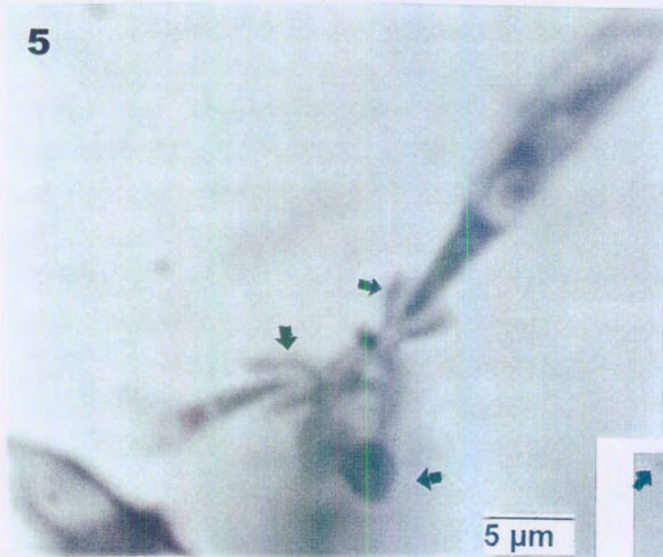
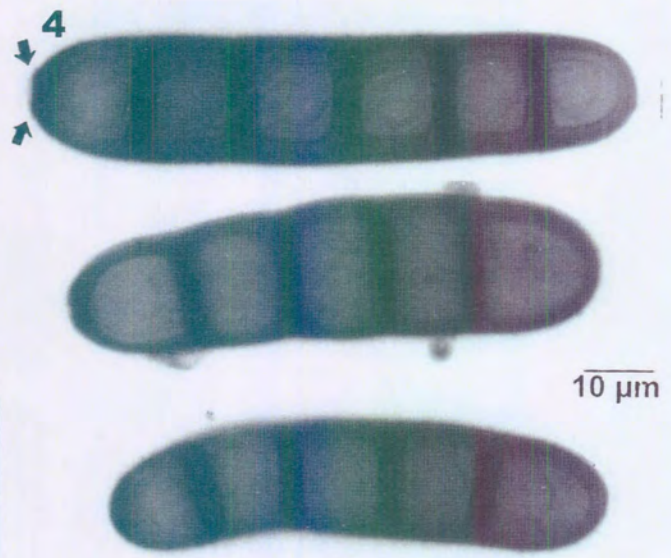
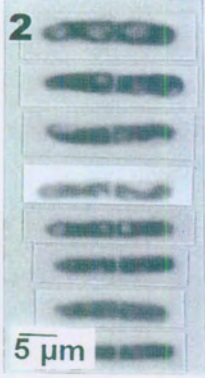


Plate 6

Diplococcium anam. state of *Helminthosphaeria clavariarum* (Tul.) Fuckel:

3. short branched chain of conidia.
4. arrow indicates slightly dumb-bell-shaped conidium because of a slight constriction at the septum that appears as a wide black band.
5. illustration of the morphology of the conidiogenous cell which is terminal, intercalary (with 3 sub-terminal cells in the main stipe).
6. branched conidiophore.

Diplococcium spicatum Grove:

1. sporulating on natural substrate, note branching of conidiophore.
2. conidia catenate, 1-septate.

Endophragmia biseptata M. B. Ellis:

- 7 - 8. conidia 2-septate, cells unequally coloured, usually uppermost cell dark brown, middle cell brown and the lowermost cell pale brown. The primary conidia when mature frequently do not come completely detached but are pushed over to one side by the rapidly developing conidiophore and remain adhered to the side of the conidiophore.

Endophragmia uniseptata M. B. Ellis:

- 9 - 11. conidia.
- 12 - 13. conidiophore base.
14. cup formed by the remnant of the lower part of a conidium.

Endophragmiella lignicola Hughes:

15. developing conidium.
16. 2-septate conidia, central cell largest, dark brown, thick-walled, apical cell and basal cell hyaline, apical cell obtuse at its end, basal cell truncate (conidia somewhat dehydrated).

Engyodontium parvisporum (Petch) de Hoog:

17. hair-shaped denticles on rachis.
18. globose conidium.
19. all but last conidium are detached.

Haplographium anam. state of *Hyaloscypha dematiicola* (Berk. & Br.) Nannf.:

- 20 - 22. penicillately arranged primary branches bearing secondary branches
23. stipe and head of conidiophore on natural substrate.
24. conidia.



PLATE 6

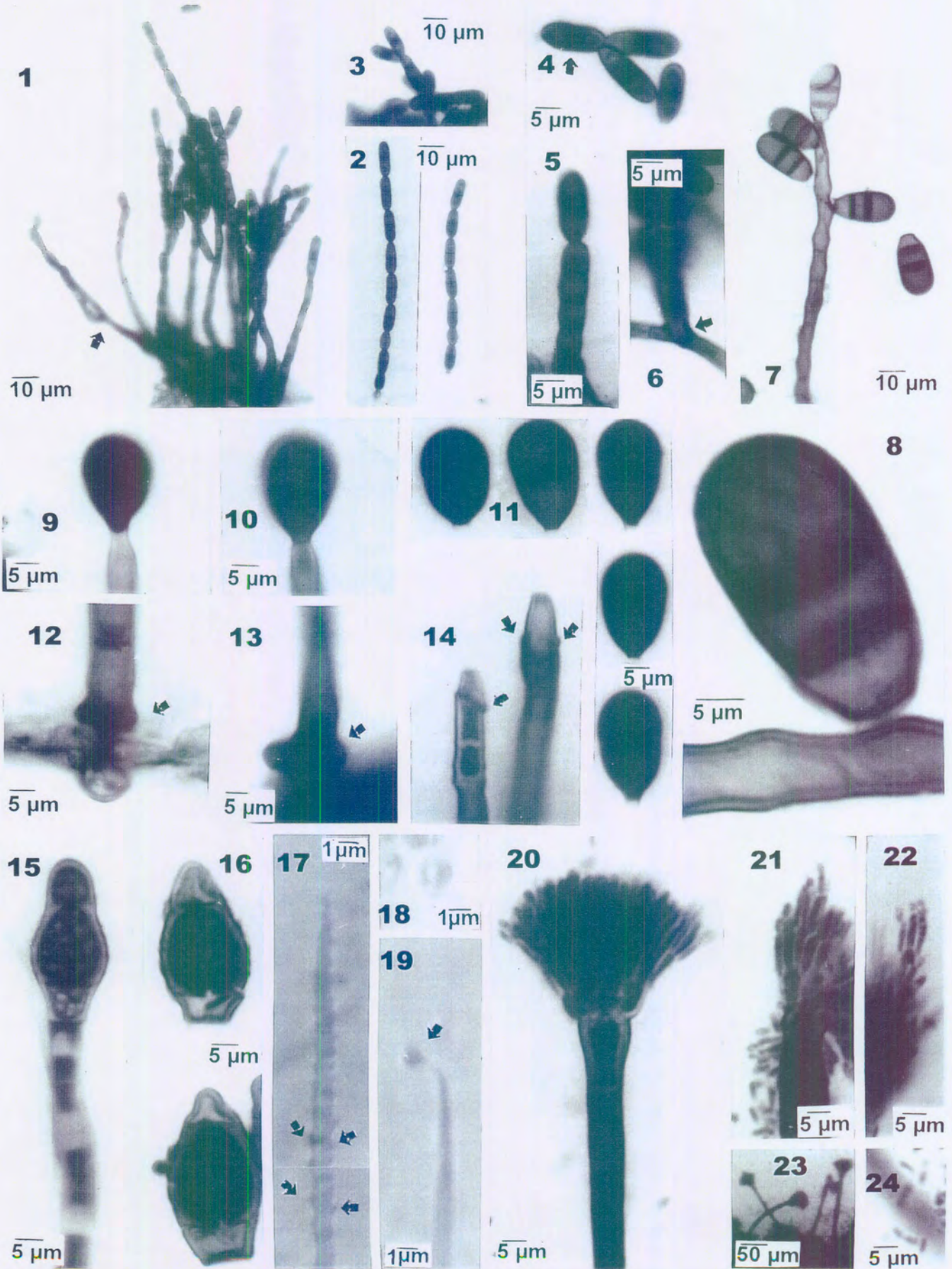


Plate 7

Helicoma dennisii M. B. Ellis:

1. conidiophores on natural substrate.
2. immature conidia prior to septation.
3. circinate helicoid conidium, filament coiled 1,25 to 1,5 times, direction of coiling centric.
4. arrows indicate hyaline denticles.

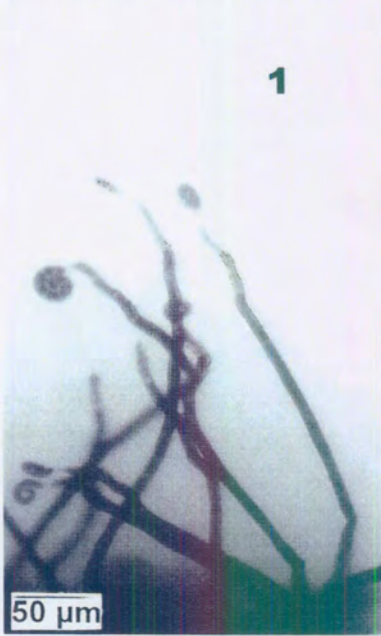
Helicosporium anam. state of *Tubeufia helicomyces* Höhnelt:

5. sporulation on natural substrate.
6. conidia borne on denticles.
7. planate helicoid conidia (filament coiled two or more times in one plane - two dimensions).



PLATE 7

1



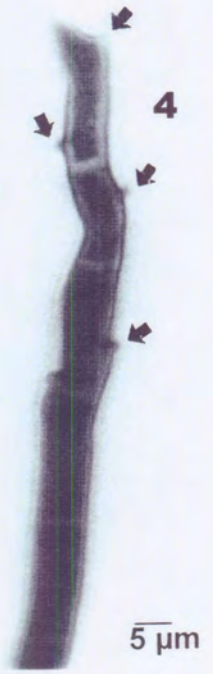
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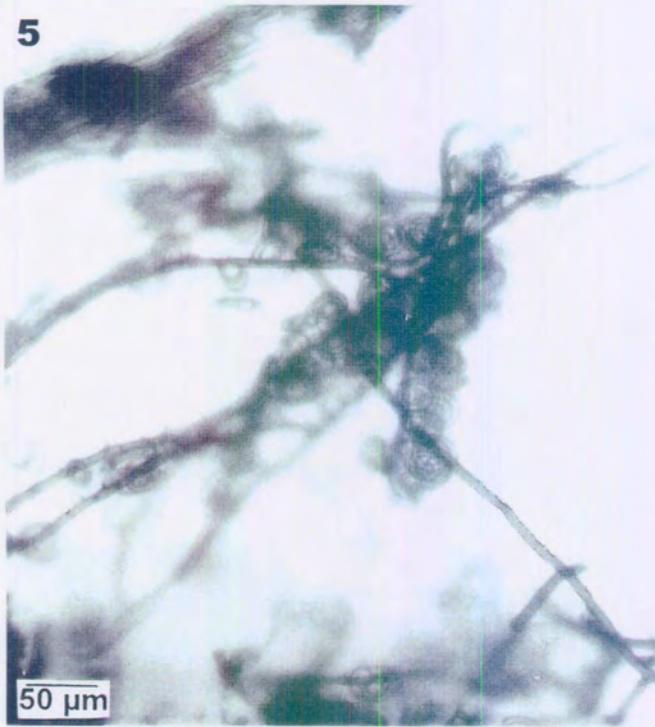
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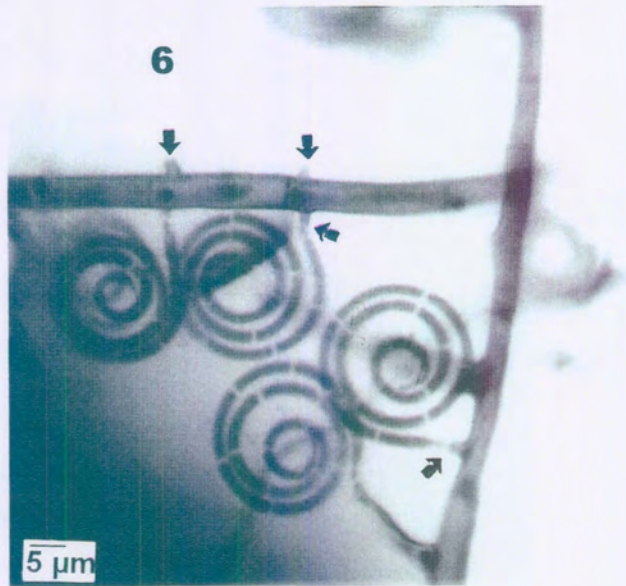
4



5



6



7



Plate 8

Henicospora minor Kirk & Sutton:

1. sporulating on natural substrate. Arrow indicates unthickened delimiting septum.
2. Conidium tapers slightly towards the base and abruptly in the rhexolytic cell.

Heteroconium solaninum (Sacc. & Syd.) M. B. Ellis:

- 3 - 6. conidial chains, constrictions delimit conidia at differing numbers of septa.
7. sporulating on natural substrate.
- 8 - 9. indeterminate growth resulting in irregularly defined conidia, i. e. variation in septation, size and shape of conidia.

Monodictys gemmipara Rao & de Hoog:

10. mature conidium and conidiophore on natural substrate.
11. and 13. conidia globose, muriform with secondary conidia on the perimeter of the main conidia.
12. and 14. basal cell of conidium indicated by arrows.

Nodulisporium radians (Berk) Deighton:

15. sporulating conidiophores on natural substrate.
16. conidiogenous locus a swollen point with subtending constriction
17. branching from points below septa.
18. aseptate conidia.



PLATE 8

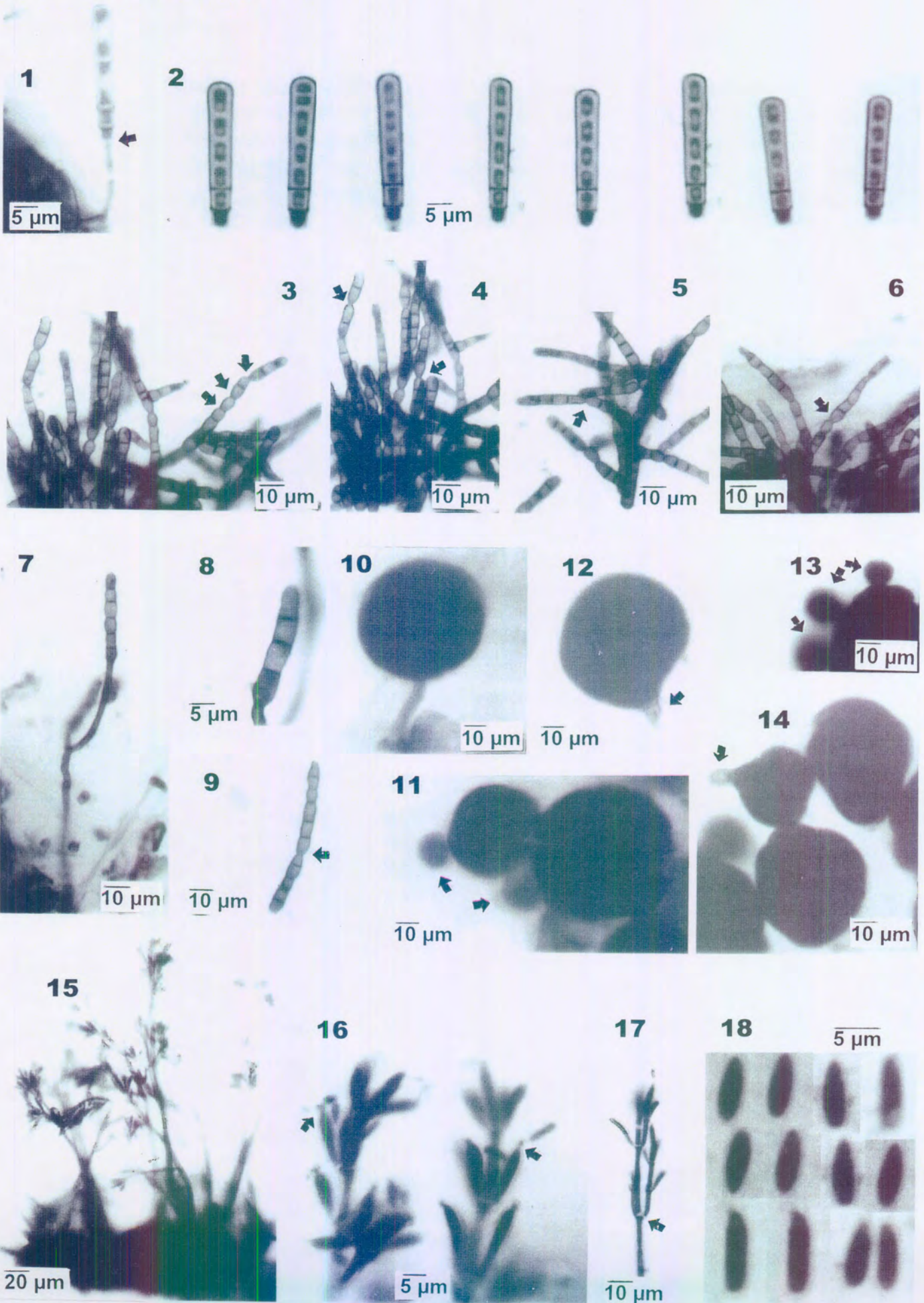


Plate 9

Oidiodendron griseum Robak, apud Melin & Nannf.:

1. sporulating conidiophore on natural substrate.
2. arthroconidia differentiating from the conidiophore branches.

Phaeoisaria clematidis Hughes:

3. synnemata.
4. synnemata composed of parallel conidiophores.
- 5 - 6. conidiophores bearing aseptate conidia.

Pleurothecium recurvatum (Morgan) Höhnel:

7. sporulating on natural substrate.
8. - 11. conidiogenous cells polyblastic, sympodial, denticulate (indicated by arrows), branching or forming a helicoid cyme, conidia ellipsoid to allantoid.

Pseudospiropes simplex (Kunze ex Pers.):

12. conidial arrangement on conidiophore.
13. conidiophore with prominent protruding scars (indicated by arrows).
14. pseudoseptate conidia.

Rhinocladiella anam. state of *Dictyotriciella mansonii* Schol-Schwarz:

15. conidiophores on natural substrate.
16. - 17. denticulate conidiophores.
18. conidia.



PLATE 9

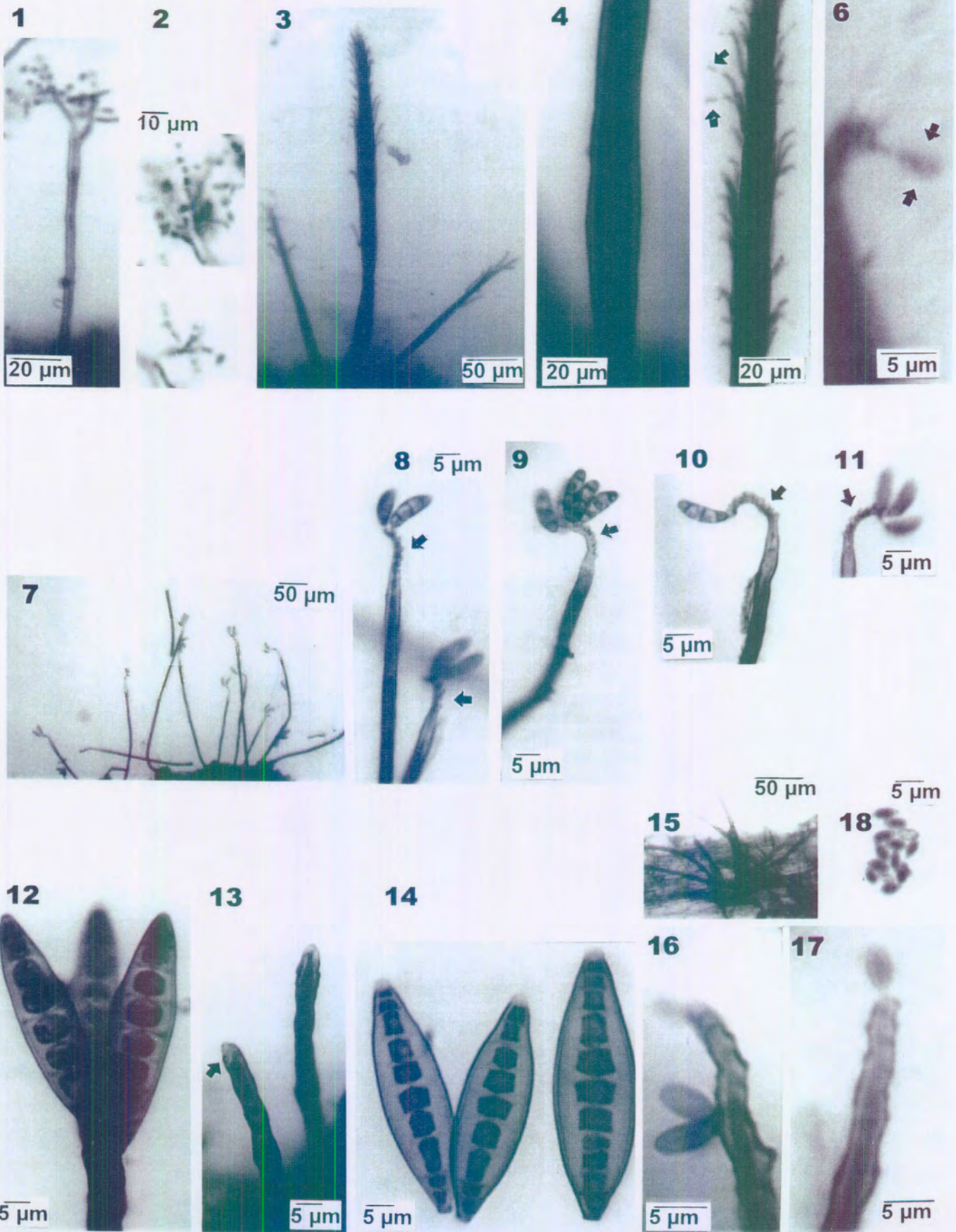


Plate 10

Rhinocladium pulchrum Hughes & Hol.-Jech.:

1. dichotomously branched conidiophore on natural substrate.

Riessia semiophora Fresenius:

2. conidia attached centrally to the synnematosus conidiophore in a perpendicular disposition (SEM).
3. thick-walled, but hyaline stauro-conidium with central axis to which synnematosus conidiophore is attached
4. synnema on natural substrate.

Selenosporella curvispora MacGarvie:

5. denticulate conidiogenous cells arranged in verticels on conidiophore.
6. sporulating conidiophore on natural substrate, arrow indicates acerose conidium

Spadicoides obovata (Cooke & Ellis) Hughes:

7. 2-septate conidia, black bands at septa.
8. after conidia secession minute pores are left on the walls of the conidiophores.
9. sporulating unbranched (simple) conidiophores on natural substrate.



PLATE 10

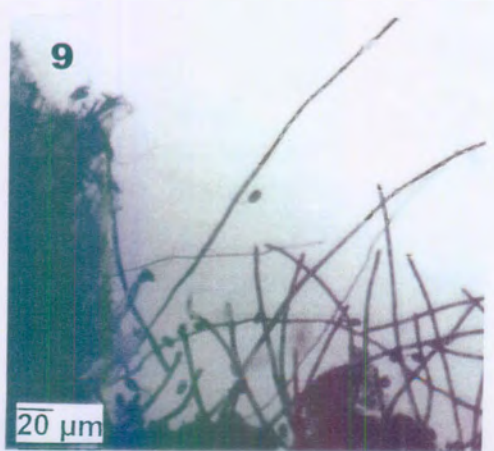
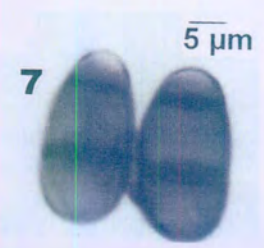
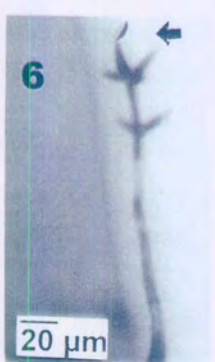
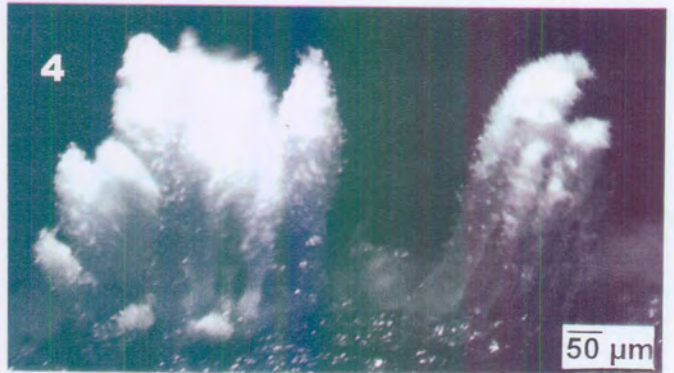
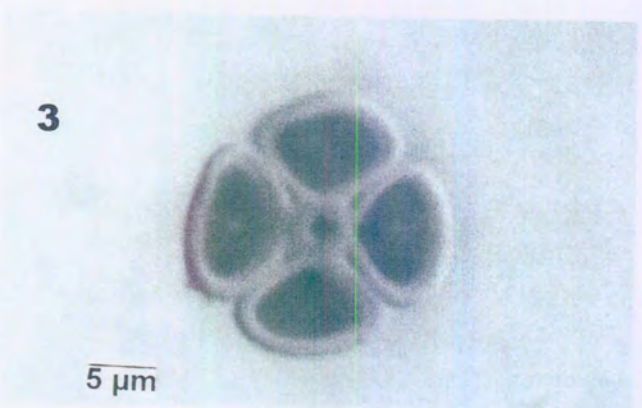


Plate 11

Sporoschisma nigroseptatum Rao & Rao:

1. growth on natural substrate, note percurrent proliferation, capitate hyphae and swollen venter of conidiophore.
2. catenate conidia formed well within the cylindrical collarette.

Stachybotrys chartarum (Ehrenb. ex Link) Hughes:

3. conidiophores on natural substrate.
4. group of phialides at apex of each conidiophore branch.
5. spherical to obovoid verruculose conidia.

Stachybotrys kampalensis Hansford:

- 6 - 8. phialidic conidiogenous cells in groups at the apex of each stipe, conidiophores frequently branched.
9. conidia ellipsoidal when young, becoming oblong on maturation.

Taeniolella scripta (Karst.) Hughes:

10. conidia, note variation in constriction at septa and size of truncate base.
11. colony on natural substrate.
12. semi-macronematous conidiophore with conidium, arrow indicating conidiogenous locus.
13. catenate conidia.



PLATE 11

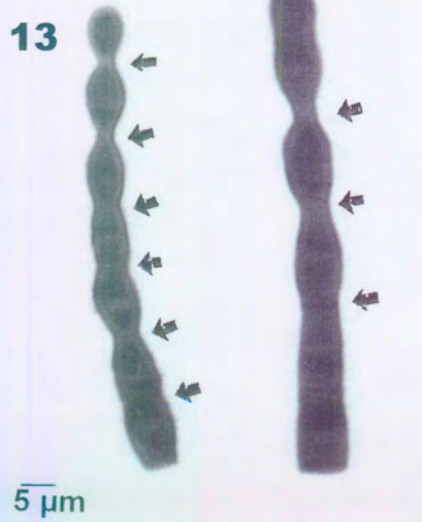
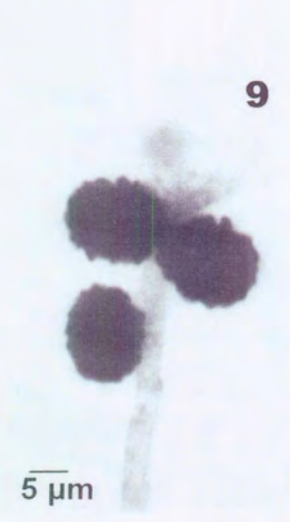
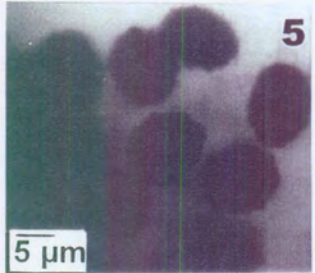
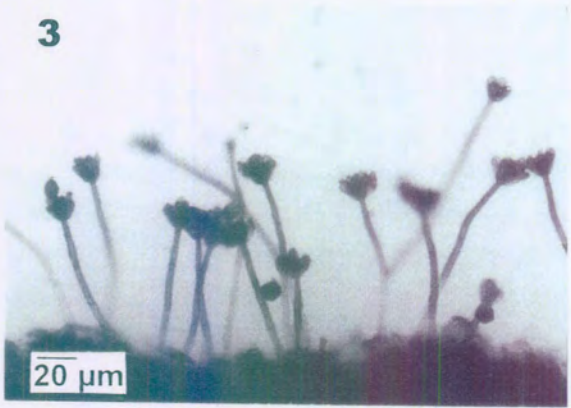


Plate 12

Tetracoccosporium paxianum Szabó:

1. developing conidium on semi-macronematous conidiophore, arrows indicate conidiogenous cell.
2. branched conidiophore with conidia at different stages of maturation, branches at right-angle to the main axis.
3. sporulating fungus on natural substrate.
4. - 5. developing conidia
6. variation in conidium size and shape as a result of different stages of maturation.

Ulocladium tuberculatum Simmons:

7. geniculate conidiophore with ellipsoidal and grossly tuberculated mature conidium and next conidium developing.

Veronaea indica (Subram.) M. B. Ellis:

8. conidia with protuberant truncate base.
9. conidiophore with developing conidium.

Virgariella atra Hughes, figures:

10. sporulating on natural substrate.
- 11 - 12. unbranched (simple) conidiophores.
13. one atypical and three typical conidia.

Virgariella sphaerica Matsushima:

- 14 - 16. conidiophores with conidia.



PLATE 12

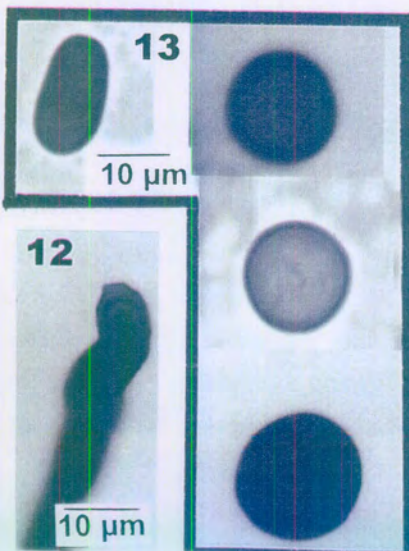
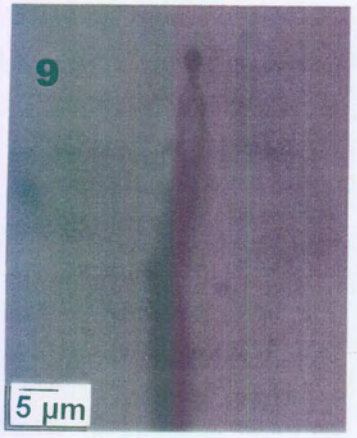
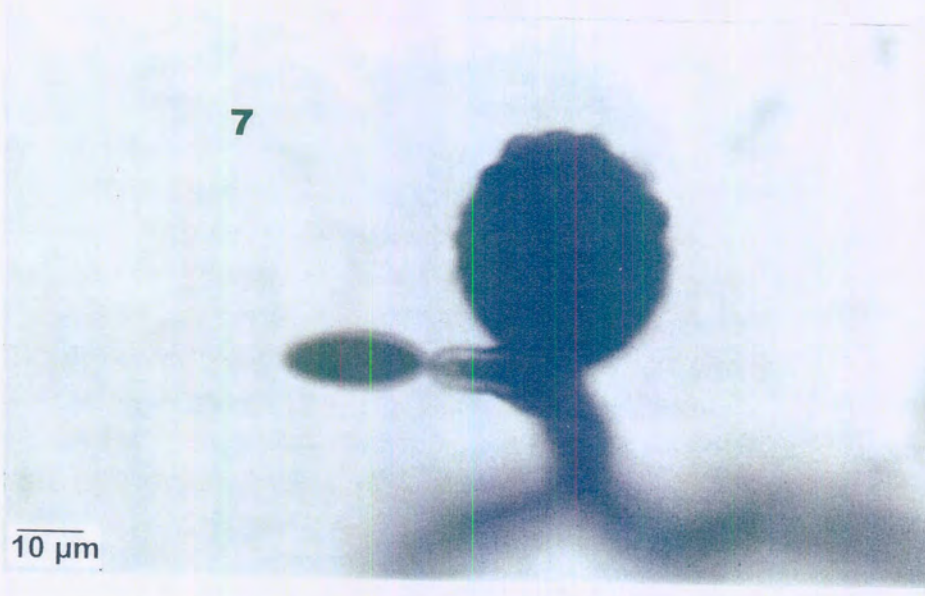
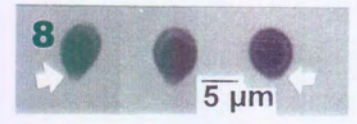
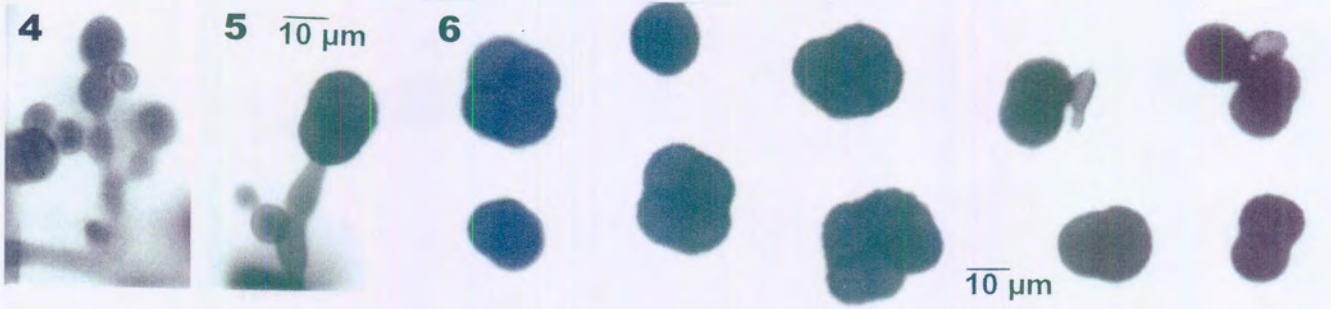
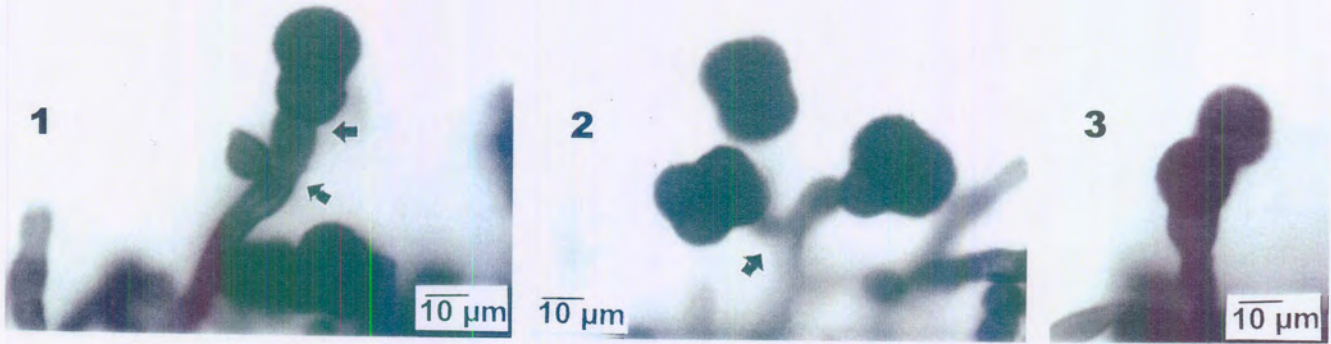




Plate 13

Monodictys capensis Sinclair, Boshoff & Eicker:

1. growth habit on natural substrate.
2. developing conidia on natural substrate.
- 3a. mature conidia from natural substrate.
- 3b. mature irregular conidia from natural substrate.
- 3c. mature irregular conidia from culture.
- 4 - 5. developing conidia in culture.
6. partially differentiated swollen cells immersed in agar from colony margin on PDA.



PLATE 13

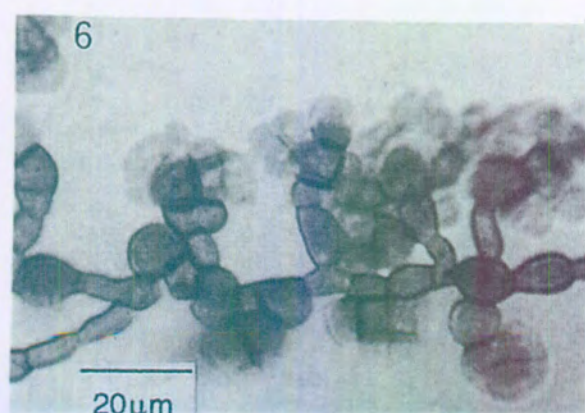
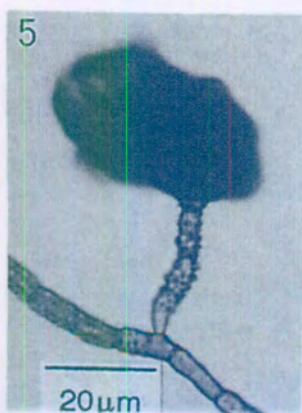
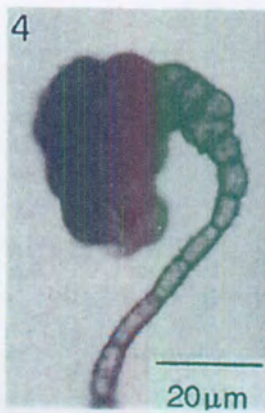
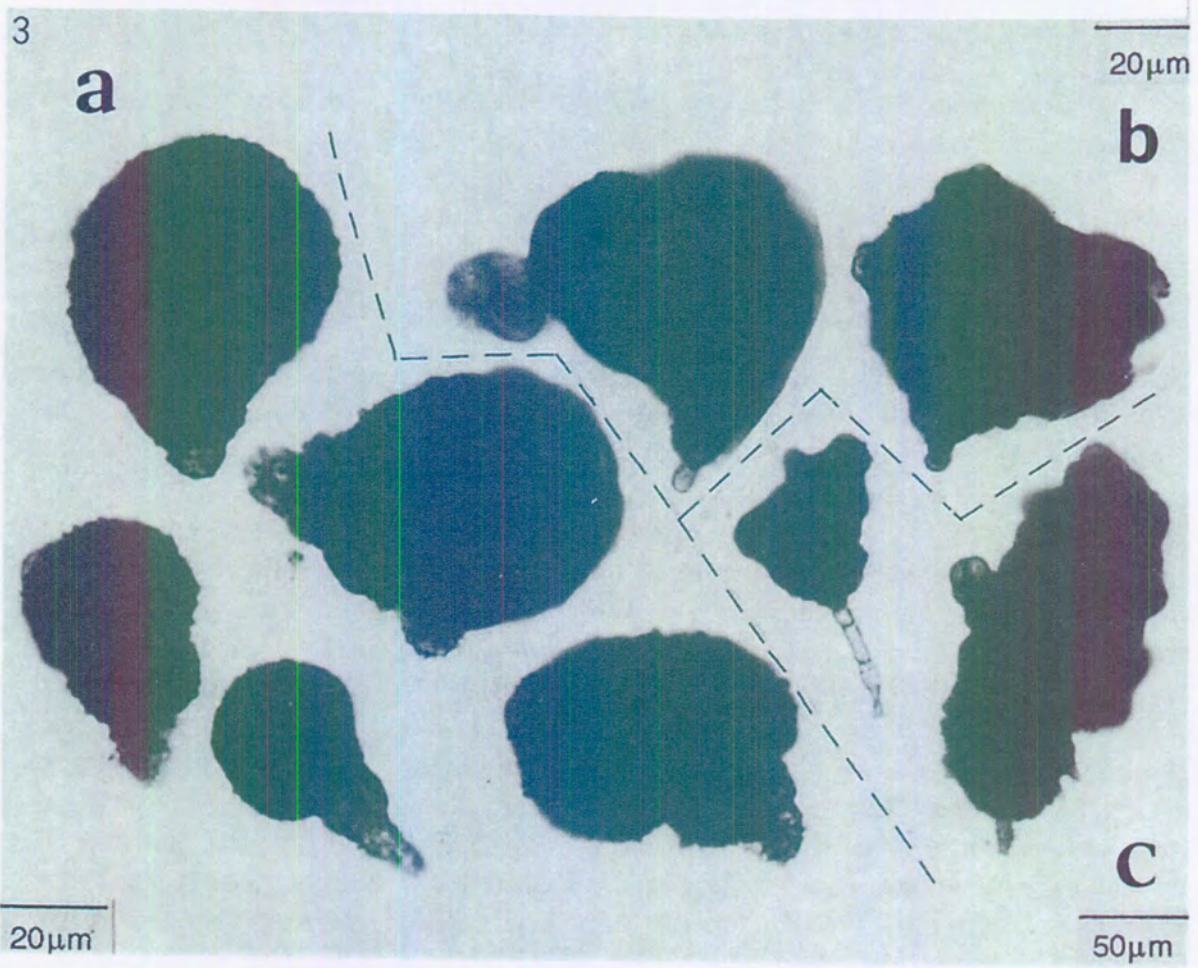
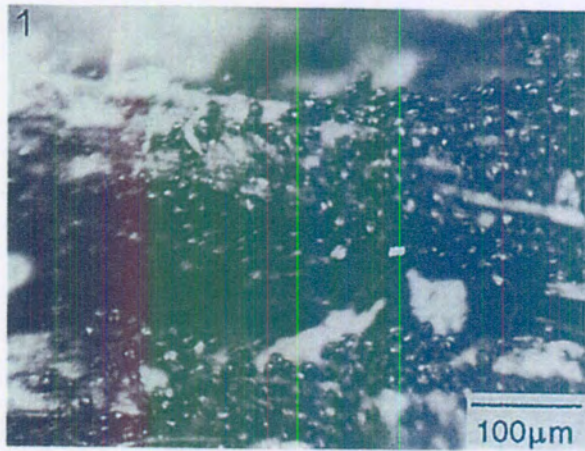


Plate 14

Monodictys capensis Sinclair, Boshoff & Eicker:

scanning electron micrographs of

7. effuse colony on natural substrate.

8. developing conidium on natural substrate.

9 - 10. fragmented conidia demonstrating thick wall and muriform septation.

11. conidium release point.

12. smooth apex of mature conidium.

13. ellipsoidal conidium.

14. conidium with irregular margin and narrow basal cells.



PLATE 14

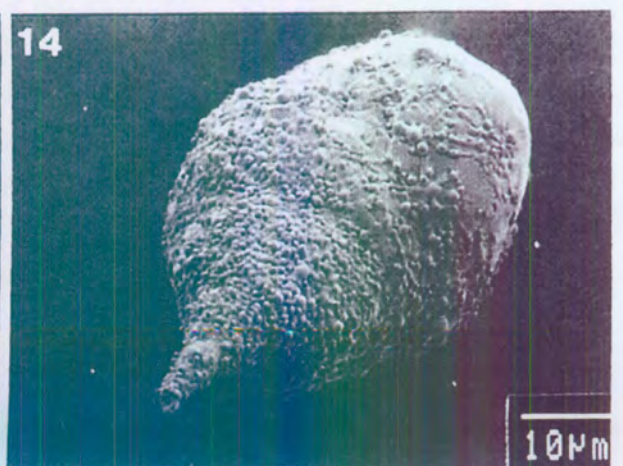
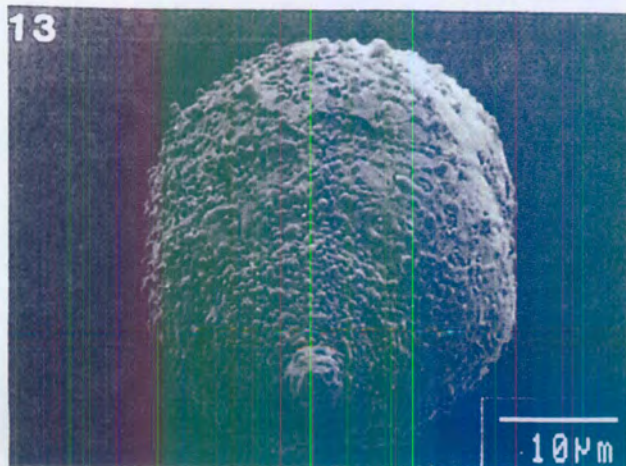
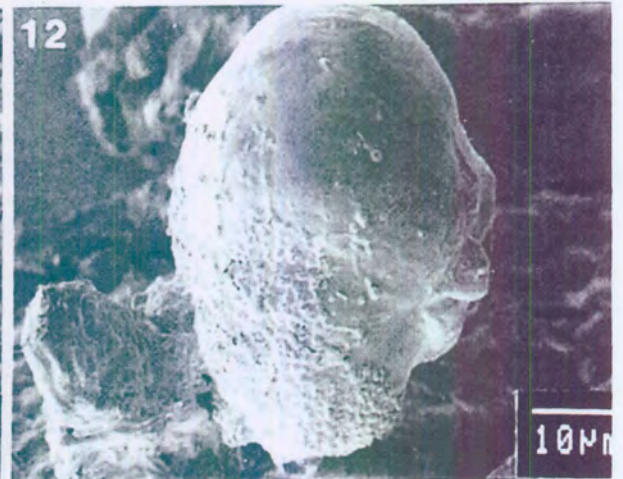
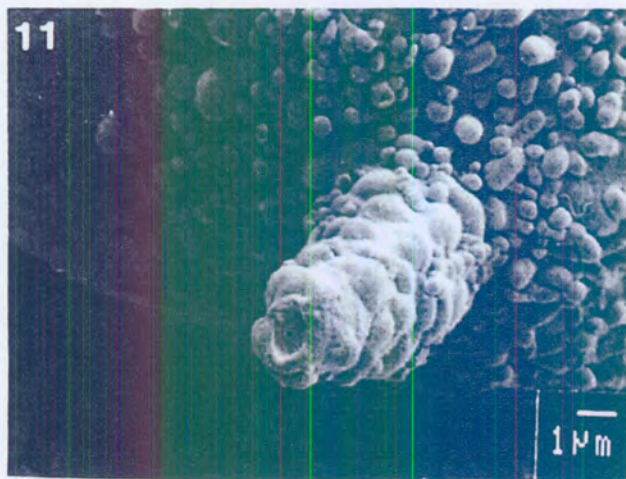
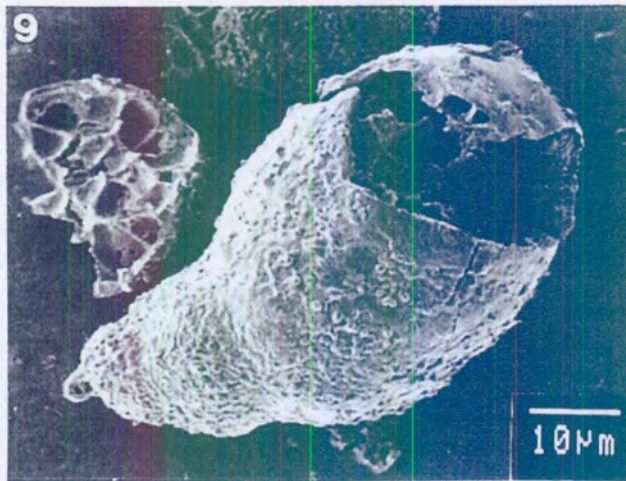
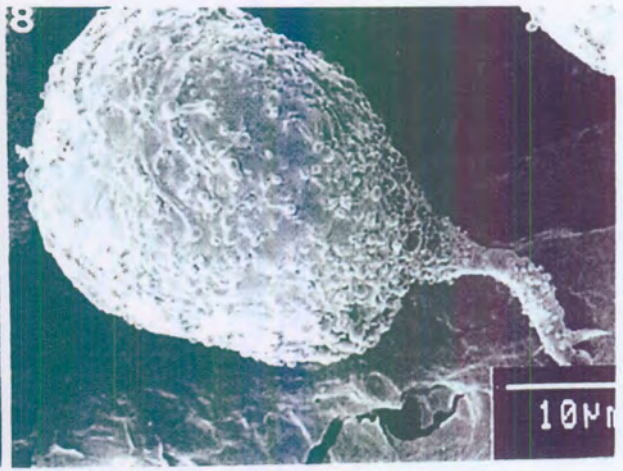


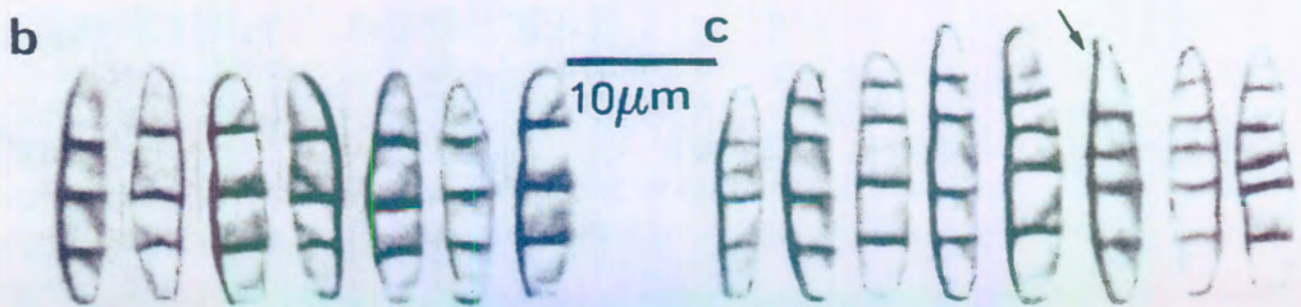
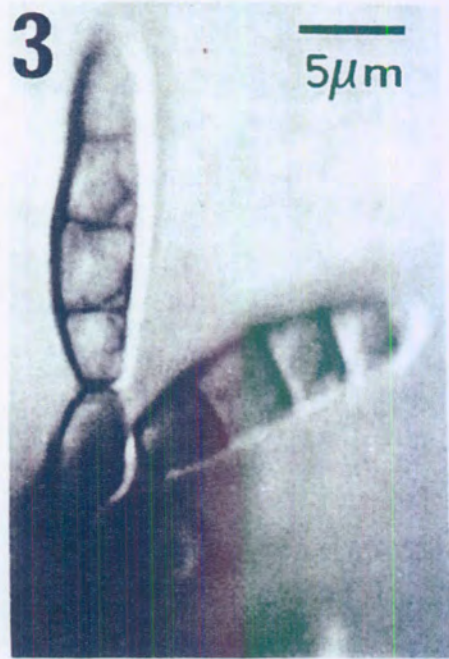
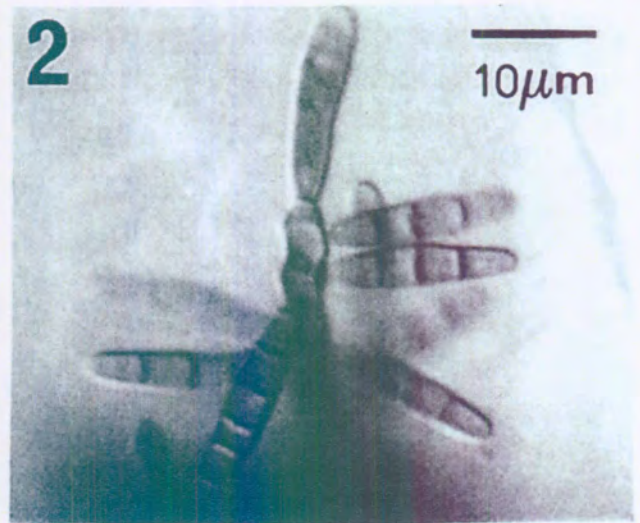
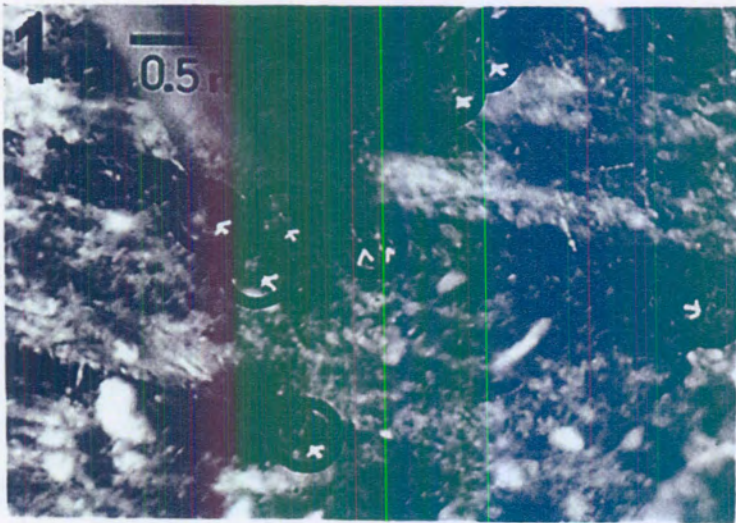
Plate 15

Sympodioplanus capensis Sinclair, Boshoff & Eicker:

1. colony on natural substrate (a 27 gauge needle shaft is in the upper left corner, conidiophores are circled and indicated with white arrows).
2. demonstration of the disposition of the conidia on the conidiophore.
3. mature conidia on a conidiophore.
4. conidiophore morphology (same scale as 3).
5. uncommon (cf. 6c) conidium on a conidiophore (same scale as 3).
- 6a & b. normal range of conidium morphology.
- 6c. uncommon 4- and 5-septate conidia (arrow denotes rare apex attenuation).



PLATE 15



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