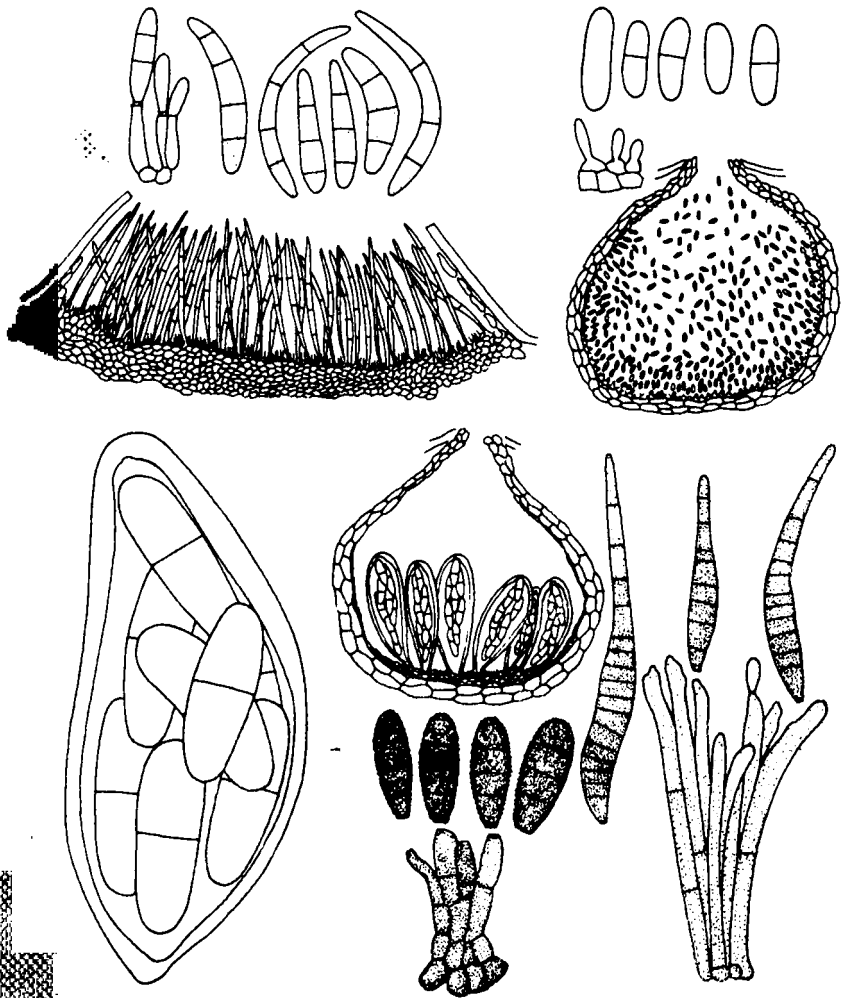
A. SIVANESAN

The Bitunicate Ascomycetes

and their anamorphs



J. Cramer

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A. SIVANESAN

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PREFACE

Knowledge of correlations of anamorphs and teleomorphs is of great importance in disease control and epidemiology. Although hundreds of such correlations have been suggested, no book dealing with them is currently available.

My aim is to compile the known correlations in species of Loculoascomycetes genera and to give full descriptions and illustrations of the teleomorph and anamorph to enable easy reference to, and identification of, one or both states. This work, however, should not be regarded as complete, since some genera and species have been omitted due either to non availability of material or insufficient information. Some genera or species have not been critically treated as characters required for separation are not fully understood or the taxa are heterogeneous and need complete revisionary study.

The book is intended as a guide from which not only confirmations and elucidations of some doubtful as well as unproved correlations by ascospore culture will result but also as a stimulant for investigating unknown connections between anamorphs and teleomorphs.

ACKNOWLEDGEMENTS

I am grateful to the Directors and Curators of the following herbaria (abbreviated according to Index Herbariorum Part I. The Herbaria of the World (comp. P.K. Holmgren & W. Keuken: ed. F.A. Stafleu), 1974): - B, BPI, C, CBS, CUP, DAOM, DAR, DUKE, FH, GH, ILL, K, LPS, MICH, NY, NYS, PAD, PC, PDD, PRE, S, TNS, TRTC, UPS, URM, W, WIS, ZT for the loan of type or other material of many fungi not represented in herb. IMI. This work could not have been completed without their co-operation. I thank my colleagues Drs. C. Booth, D.L. Hawksworth and E. Punithalingam for helpful discussions. I am grateful to Mr. B. Spooner of The Herbarium Royal Botanic Gardens, Kew for his suggestions and general comments. Finally, my thanks to Joan Woodhams for her skilful technical assistance.

PREFACE

Knowledge of correlations of anamorphs and teleomorphs is of great importance in disease control and epidemiology. Although hundreds of such correlations have been suggested, no book dealing with them is currently available.

My aim is to compile the known correlations in species of *Leucostoma*, mycetes genera and to give full descriptions and illustrations of the teleomorph and anamorph to enable easy reference to, and identification of, one or both states. This work, however, should not be regarded as complete, since some genera and species have been omitted due either to non availability of material or insufficient information. Some genera or species have not been critically treated as characters required for separation are not fully understood or the taxa are heterogeneous and need complete revisionary study.

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INTRODUCTION

Many fungi are pleomorphic and can exist in more than one independent form or spore stage in their complete holomorphic cycle, having a teleomorphic or sexual state (the Ascomycotina or Basidiomycotina) and one or more anamorphic or asexual states (Hyphomycetes or Coelomycetes). Both may serve in the propagation of the species and may or may not be parasitic. Numerous correlations of teleomorphs and anamorphs have been suggested in the literature but evidence for these varies widely in degree of authenticity. The most recent and complete list of correlations, with comments on the degree of authenticity, has been compiled by Kendrick & DiCosmo (Kendrick, 1979). Carmichael *et al.* (1980) provided a list of hyphomycetes and their teleomorph connections. Recently Tubaki (1981) has also reviewed hyphomycete and teleomorph connections.

Form, structure and type of development of ascomata, ascus structure and method of discharge of ascospores are all important features used in the classification of ascomycetes. Ascomata of Loculoascomycetes show a wide range of form and structure and this has been illustrated and described by Booth (1966). Three major developmental types, *Elsinoe*-type, *Dothidea*-type and *Pleospora*-type (Luttrell, 1951), can be recognised but variations within these may occur. In the Myriangiales, typified by *Elsinoe* the globose asci are scattered singly and usually at many levels in a relatively undifferentiated crustose, pulvinate, discoid or subglobose stromatic mass. (Fig. 190). The asci may be distributed throughout the stroma or limited to fertile regions of the stroma. The asci expand above the surface through the soft or crumbling apical tissue and discharge the ascospores. The ascomata of Dothideales characterized by *Dothidea*-type of development may be separate, grouped on a common basal stroma or completely immersed in the stroma. The stroma itself may be superficial, erumpent or immersed in the host substrate. The ostiole is formed lysigenously, less commonly schizogenously. The ovoid to cylindrical asci are fasciculate in uni- to multi-locular ascocarps and either disintegrate the centrum parenchyma or grow up between the pseudoparenchyma cells, and are aparaphysate. The cells of the sterile centrum may, however, be compressed or may elongate between maturing asci and remain as pseudoparaphysoids (interthecial tissues). The ascomata become cup-shaped in some genera, for example *Dothiora,* where the asci are laterally disposed and become exposed by rupture of the overlying stromatic tissue. In members of Hysteriaceae the asci become exposed by opening of the

linear folded hysterothecioid ascomata. Ascomata of Patellariaceae are apothecioid. The asci are interspersed with pseudoparaphyses which branch and swell at the tips to form an epithecium over the asci which are exposed by shedding the upper portion of the outer wall. In the Pleosporales the ascoma is perithecioid and usually unilocular, occasionally multilocular. The cylindrical to cylindric-clavate asci are dispersed among pseudoparaphyses, which may be cellular or trabeculate. Cellular pseudoparaphyses are formed by a downward growth from meristematic cells at the apex of a central locule and fusion with tissues at the base. They are usually septate, simple or branched, sometimes anastomosing above the asci, sometimes deliquescent when the asci are mature and usually about 2 μm wide. The trabeculate pseudoparaphyses characteristic of genera like *Astrosphaeriella, Lophiostoma, Melanomma* and *Thyridaria* are formed by stretching and intercalary growth of already existing cells between apex and base of the locule as it expands. They are narrow, 1-1.5 μm wide, filamentous, usually non septate, branched and anastomosing or unbranched above the asci and embedded in a gelatinous matrix. In *Pleospora herbarum,* the elongation of pseudoparaphyses takes place by addition of new hyphal cells apically and by elongation of some of the intercalary cells of each pseudoparaphysis (Corlett, 1973).

In Metacapnodiaceae centrum development is typically Pleosporaceous (Corlett, Hughes & Kaufert, 1973) but differs in that the pseudoparaphyses remain relatively short apically and/or laterally and do not grow down to the base of the locule. Such pseudoparaphyses were termed periphysoids by Barr (1979) to distinguish them from the periphyses of unitunicate ascomycetes. These are, perhaps, better called pseudoperiphysoids in co-ordination with the terms pseudoparaphyses and pseudoparaphysoids. Such pseudoperiphysoids are seen in *Plurisperma dalbergiae* (Sivanesan, 1970a) and in *Scirrhia acicola* (Luttrell, 1973). The range of ascomatal types in the Pleosporales is similar to those found in Dothideales.

In the Loculoascomycetes the ascus is bitunicate and develops within an ascoma formed by pseudoparenchymatous cells. Karyogamy occurs within the young ascomata. The asci are formed on or from an ascogenous hyphal system and the young ascus is thin-walled. As it develops, an inner layer termed the endotunica or endoascus is laid within the primary outer wall layers (ectotunica or ectoascus) and the ascus becomes conspicuously thickened toward the apex where it is usually indented or partly pierced by a narrow tubular opening forming a subapical internal beak into which the protoplast extends. Ascospores are released through this pore. In the few species studied, both layers are composed of microfibrils embedded in an amorphous matrix and only

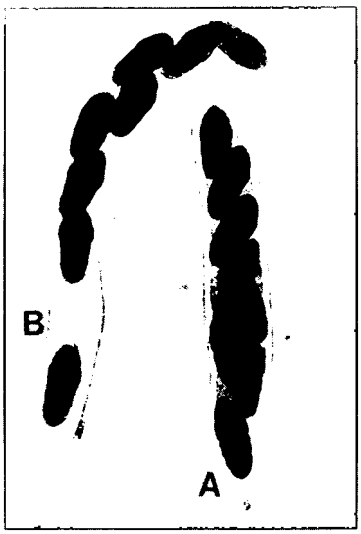


Fig. 1. A, a mature bitunicate ascus of *Pleospora* sp.; B, ascus at the time of ascospore release showing an almost fully extended endotunica with trapped ascospores and remains of basal and apical thimble-like cap of ectotunica.

differ in the arrangement of the microfibrils. The two walls are physically separable from each other during the time of ascospore discharge.

The mechanism of ascospore discharge has been fully described by Luttrell (1973). The ascospores are released by rupture of the thin inextensible outer ectotunica followed by the increase in length of the thick, extensible inner endotunica. The ascus dehisces by lateral or apical rupture of the ectotunica. When it dehisces apically the ascus apex is thrown off as a thimble-shaped cap (Fig. 1). The endotunica then rapidly increases in length as a tube-like extension often two or three times the length of the ascus. The ascospores push up into the endotunica, the first ascospore is trapped in the elastic pore at the tip, usually at it widest part, pressure is built up in the tube below and the ascospore is violently discharged. The second ascospore then moves into the pore and the pressure is rebuilt before the ascospore is released. The process is repeated so that the whole group of ascospores are released in rapid succession. Often the ascospore or groups of ascospores are released at intervals by spatial separation from each other as they are constricted on passing through the pore. The ascus shrinks after all the ascospores have been discharged. The entire process of ascus rupture and ascospore discharge can be observed in many Loculoascomycetes, especially in

coprophilous genera like *Sporormiella* by the method described by Ingold & Hadland (1959).

In some species the endotunica is not completely functional or apparently plays no part in ascospore discharge. In *Botryosphaeria* sp., the endotunica tends to swell and deliquesce as soon as the ectotunica splits. In *Cochliobolus sativus* the endotunica may break down and take no part in ascospore release, while in *Cochliobolus cymbopogonis* the endotunica is incomplete at its base but is functional (El Shafie & Webster, 1980) and the ascus has been termed 'vestigeal bitunicate' (Hall & Sivanesan, 1972).

Ripening and discharge of ascospores in many genera is timed to coincide with the onset of vegetative growth or flowering of the host in the following season when the host is especially susceptible to infection.

A non-amyloid ring staining with black ink or congo red is visible in many genera, especially in *Pyrenophora* and *Wettsteinina* (Eriksson, 1967a). The apex of a bitunicate ascus never stains blue with iodine (non-amyloid), although some gelatinized sterile tissue in some species may do so.

CLASSIFICATION

Among mycologists there is no general agreement regarding the systematic subdivision of Ascomycotina. The genera of Loculoascomycetes have been placed in various orders, and the number of orders and families varies from author to author. Nannfeldt (1932) placed the genera in four orders, Luttrell (1951, 1955, 1973) in five, Müller & von Arx (1962) in three, von Arx & Müller (1975) in one, Booth (1978) in six, Dennis (1978) in five, and Barr (1979) in eight. Barr (1979) placed the genera with trabeculate pseudoparaphyses in a separate order Melanommatales to distinguish those genera of the Pleosporales with cellular pseudoparaphyses. In members of Didymosphaeriaceae and Melanommataceae, the trabeculate pseudoparaphyses are very distinct, and taken in conjunction with ascomatal characters, may be considered significant at the level of family rather than order. Life-histories and ontogenetic studies of the majority of species and genera have not been investigated and until such time that they are all known, it is impossible to arrive at a reliable natural classification. The families of bitunicate ascomycetes have been treated in detail by Eriksson in *Opera Botanica* **60**, 1981.

LOCULOASCOMYCETES

Order Capnodiales	Family Capnodiaceae
	Englerulaceae
	Euantennariaceae
	Parodiopsidaceae
Order Chaetothyriales	Family Chaetothyriaceae
	Herpotrichiaceae
	Metacapnodiaceae
	Naetrocymbaceae
	Trichothyriaceae
Order Dothideales	Family Dothideaceae
	(Botryosphaeriaceae, Dothioraceae,
	Mycosphaerellaceae)
	?Eremycomycetaceae
	?Piedraiaceae
	Pseudosphaeriaceae
Order Hysteriales	Family Arthoniaceae
	Hysteriaceae
	Lophiaceae
	Patellariaceae

Order Microthyriales	Family Asterinaceae
	Brefeldiaceae
	Microthyriaceae
	Micropeltidaceae
	Phillipsiellaceae
	(Parmulariaceae)
	Saccardiaceae
	Schizothyriaceae
	(Microthyriellaceae,
	Saccardinulaceae)
	Vizellaceae
	(Entopeltidaceae)
Order Myriangiales	Family Seuratiaceae
	Myriangiaceae
Order Pleosporales	Family Arthropyreniaceae
	Didymosphaeriaceae
	Melanommataceae
	(Fennestellaceae,
	Lophiostomataceae,
	Massariaceae)
	Microglaenaceae
	Pleosporaceae
	(Cucurbitariaceae,
	Dimeriaceae, Massarinaceae,
	Phaeosphaeriaceae,
	Pleomassariaceae,
	Pyrenophoraceae)
	Sporormiaceae
	Strigulaceae
	Testudinaceae
	Trypetheliaceae
	Tubeufiaceae
	(Acrospermaceae)
	Venturiaceae
	(Munkiellaceae,
	Stigmataceae).

Diagnostic characters and key to orders

The diagnostic characters employed in distinguishing orders of Loculoascomycetes are based on the type and nature of development of the ascomata and presence or absence of interthecial filaments.

Key to Orders

Ascomata thyriothecioid..... Microthyriales

Ascomata hysterothecioid or apothecioid with or without longitudinal cleft.. ..... Hysteriales

Ascomata an undifferentiated pseudoparenchyma or a gelatinous thallus.... ..... Myriangiales

Ascomata pseudothecioid or if apothecioid then lacking interthecial elements..... 1

1. Interthecial filaments absent..... 2

   Interthecial filaments present..... 3

2. Pseudothecia immersed to erumpent..... Dothideales

   Pseudothecia entirely superficial, often on or in a subiculum... Capnodiales

3. Pseudoparaphyses present..... Pleosporales

   Pseudoparaphyses absent, apical lateral pseudoperiphysoids sometimes present..... Chaetothyriales

Artificial keys are provided to genera of different familes as well as to species of each genus, if it is not monotypic. Keys to species of certain genera are not provided as distinction is only possible when identity of the host is known. Size, shape, septation and ornamentation, and the presence or absence of a gelatinous sheath around ascospores in conjunction with ascomatal characters, are used for delimitation of taxa. Similar characters for conidia are employed in keys to the anamorph. Ascospores and conidia develop additional septa or become slightly pigmented with age and these characters should be considered before generic or specific distinctions are made. In addition tables depicting the important characters of included genera are provided as a supplement. In some cases two or three genera will have the same characters in the table and for further distinction between these, descriptions must be consulted. For characters delimiting genera of

Coelomycetes and Hyphomycetes works by Sutton (1980) and Ellis (1971, 1976) respectively should be consulted. However, too much emphasis should not be placed on basic differences in conidiogenesis between anamorphs of closely related teleomorphs.

Monographs of individual groups and genera are cited in appropriate places. Useful taxonomic treatments of various groups of microfungi may be consulted in the following works by von Arx & Müller (1954, 1975) on Ascomycetes, Dennis (1978) on Ascomycetes, Ellis (1971, 1976) on Hyphomycetes, Carmichael *et al.* (1980) on Hyphomycetes, Müller & von Arx (1962) on Ascomycetes, Munk (1957) on Ascomycetes, Subramanian (1971) on Hyphomycetes and Sutton (1980) on Coelomycetes. For a comprehensive treatment of Loculoascomycetes see Luttrell (1973). Fungi causing diseases of tropical crops are adequately covered by Holliday (1980).

TABLE 1

Position of ascomata on substrate			Form of ascomata other than pseudothecium			Stroma or subiculum if present			Other ascomata characters			Substrate					Form of mycelium			Ascospores		Genera
Superficial	Immersed	Erumpent	Thyriothecioid	Hysterothecioid	Apothecioid	On or in a subiculum	On or in a basal stroma	As locules in a stroma	Often brightly coloured	Setose	Setae only in ostiole	On leaves	On stems, wood, bark	On florets of *Carex*	On Gymnosperm	Hyperparasitic	With mucilaginous walls	Hyphopodiate	Setose	Unequally septate	With mucilaginous sheaths	Septation and pigmentation	
	*	*					*						*								* °	Hyalosporae	Botryosphaeria
*							*	*						*									Melanodothis
	*											*									* °		Discosphaerina
	*											*								*			Guignardia
*				*									*									Phaeosporae	Farlowiella
*												*											Pilgeriella
*			*																				Vizella
	*	*					*					*										Hyalodidymae	Anthracostroma
	*	*						*				*											Cymadothea
	*											*	*										Didymella, Mycosphaerella
*		*					*	*				*											Microcyclus
*			*													*							Trichothyrium
*						*									*								Xenomeris
*										*		*					*					Hyalophragmae	Aithaloderma
*																							Seuratia
*										*		*						*					Dennisiella
*	*	*								*										*			Setosphaeria
	*							*							*								Eudarluca
	*												*							*			Massarina
	*										*		*										Keissleriella
	*																			*			Leptoguignardia
	*	*						*							*								Scirrhia
	*	*										*											Sphaerulina
*			*				*					*					*					Phaeodidymae	Asterodothis
*			*									*					*						Asterina, Clypeolella
*			*									*					*						Maurodothina, Yamamotoa
*			*									*						*					Placosoma
*			*									*											Eupelte, Morenoina
*			*									*					*						Schiffnerula
*			*									*					*						Rhytidenglerula
*												*					*						Balladynopsis
*								*				*											Allosoma, Alina
*									*			*											Perisporiopsis
	*							*				*								*			Platychora
	*	*				*	*	*				*								*			Atopospora
*						*		*				*	*							*			Apiosporina
	*											*											Venturia
	*	*											*										Otthia
*						*							*								*		Herpotrichia
	*												*										Didymosphaeria
		*											*										Microthelia
*					*																		Eutryblidiella
*				*																			Farlowiella
*						*																	Zeuctomorpha

° With or without

TABLE 2

Position of ascomata on substrate			Form other than pseudo-thecium		Stroma or subiculum if present				Substrate					Form of mycelium				Ascospores		Genera
Superficial	Immersed	Erumpent	Thyriothecioid	Hysterothecioid	On or in a subiculum	On or in a basal stroma	As locules in stroma	Setose	Often brightly coloured	On leaves, leaf sheaths	On stems, wood, bark	On Gymnosperms	On resins	On scale insects	Moniliform	Repent hyphae present	With mucilaginous walls	Hyphopodiate	Punctate or verrucose	With mucilaginous sheaths	Septation and pigmentation	
*										*								*				Batistinula
*					*	*				*												Chevalieropsis
*					*						*	*				*						Euantennaria
*					*						*				*							Ophiocapnocoma
*					*					*	*	*			*							Metacapnodium
*										*						*						Acrogenotheca, Brooksia
*									*	*												Perisporiopsis
*				*							*											Hysterium, Mytilinidion
	*	*									*											Leptosphaeria
*					*						*									*°		Herpotrichia
	*									*	*								*	*°		Paraphaeosphaeria
*	*	*									*											Melanomma
	*	*				*					*											Thyridaria
*			*							*												Uleothyrium
*										*												Meliolina, Ophioparodia
*										*							*					Capnodium, Phragmocapnias
*					*					*	*						*					Scorias
	*	*									*									*°		Dothiora
	*	*									*									*		Asteromassaria
	*						*			*	*											Elsinoë
	*										*	*										Pringsheimia
*					*					*	*						*					Scorias
*					*					*							*					Capnodium, Phragmocapnias
*					*					*	*	*			*							Metacapnodium
*					*						*				*							Ophiocapnocoma
*					*							*	*									Strigopodia
	*	*			*	*					*											Cucurbitaria
	*	*			*							*										Cucurbidothis
*		*					*					*										Gemmamyces
	*										*									*°		Pleospora
	*								*	*										*°		Pyrenophora
	*	*									*									*°		Splanchnonema
	*	*									*									*°		Dothiora
	*	*									*	*										Sydowia
*									*	*												Trichopeltheca
									*													Dictyotrichiella
	*										*								*	*		Pleomassaria
*					*				*				*									Podonectria
*					*				*		*											Tubeufia
*					*						*											Thaxteriella
		*							*	*	*											Acrospermum
	*	*									*											Rhytidiella
	*																					Cochliobolus, Ophiobolus

Phaeophragmae

Hyalo-dictyae

Phaeodictyae

Filiform or acerose, hyaline to subhyaline

° With or without

COLLECTION OF MATERIAL AND TECHNIQUE

The basic equipment for recognition and collection of microfungi and the description of the technique employed in preparation of materials for microscopic examination will be found for Ascomycetes in Dennis (1978), and for Coelomycetes in Sutton (1980). Hawksworth (1974) gives a more general account of collection and preservation and the technique involved. For techniques of isolation and culture see Booth (1971a,b) and Sutton (1980), and for methods of establishing a connection between anamorph and teleomorph see Kendrick *et al.* (1979).

Definitions of mycological terms are provided by Ainsworth *et al.* (1971), by Ellis (1971, 1976) and by Sutton (1980).

In the present account lichenicolous and lichenised loculoascomycetes are not considered with the exception of *Abrothallus*. For information on these and their anamorphs see Hawksworth (1979, 1981a, b), Henssen & Jahns (1973), Santesson (1952), and Vobis & Hawksworth (1981).

As far as possible type and authentic specimens have been examined. When a drawing has been made from the type material, it has been indicated in the legend to text-figures.

ANAMORPHS IN LOCULOASCOMYCETES

Some teleomorph genera develop very similar anamorphs, thus indicating a close relationship between the genera. In *Tubeufia* and *Thaxteriella* for example the anamorph forms helicoid conidia belonging either to *Helicomyces* or *Helicoma,* genera which are very similar and reflect the close relationships of the teleomorphs. Similarly, *Cochliobolus, Pyrenophora* and *Setosphaeria* have in common a *Drechslera* anamorph. However, those *Drechslera* species characterized by conidia with protuberant hila have a teleomorph belonging exclusively to *Setosphaeria.* Some species of *Cochliobolus,* on the other hand, produce a *Curvularia* anamorph, and indeed the *Curvularia* anamorph is always associated with a *Cochliobolus* teleomorph.

Genera of Capnodiaceae produce only pycnidial anamorphs, but little is known about their conidiogenesis. In contrast, genera of Parodiopsidaceae produce almost exclusively hyphomycetous anamorphs, a *Septoidium* state being common to several genera. Chaetothyriales have exclusively hyphomycetous anamorphs. *Antennatula* is common to both *Euantennaria* and *Strigopodia.*

A *Sphaceloma* anamorph is known for most of the genera of Myriangiales. *Mitteriella* and *Sarcinella* anamorphs are common to *Clypeolella* and *Schiffnerula,* whilst one species of *Yamamotoa* also has a *Mitteriella* anamorph. *Asterina clasterosporium* and *Asterodothis solaris* both have *Clasterosporium* anamorphs.

In the Hysteriales, a *Septonema* anamorph is known for *Hysterium insidens, Mytilinidion karstenii* and *M. scolecosporum.*

It is interesting to note in addition, that species of some genera, for example, *Clypeolella, Euantennaria, Metacapnodium, Ophiocapnocoma, Perisporiopsis, Schiffnerula, Strigopodia* and *Trichopeltheca* have more than one anamorph.

CAPNODIALES

Hyphae superficial, dematioid, subiculate or may form a thallus one cell thick, with or without hyphopodia, cylindrical or flattened, with or without mucilaginous wall. Pseudothecia superficial, more or less globose or columnar, simple or lobed, smooth or with hyphal appendages, with or without a sterile basal stalk, usually opening by gelatinization of the apical cells at maturity, with a thin peridium. Asci developing at least initially in and separated by thin-walled interthecial tissues; these tissues may disintegrate early.

A *Dothidea*-type of pseudothecial development has been reported for species of *Aithaloderma* (Corlett, 1970) *Capnodium* (Fraser, 1935), *Euantennaria* and *Trichopeltheca* (Corlett, Hughes & Kaufert, 1973), all of which belong to this order.

Anamorphs variable and both pycnidial and hyphomycetous types have been found. The genetic connection between the teleomorph and anamorph is circumstantial, but is strongly suggested by attachment to the same kind of mycelium and by very close association. It has only been established in some members of Capnodiaceae by cultural studies.

Key to families of Capnodiales

Hyphae with mucilaginous walls..... Capnodiaceae

Hyphae without mucilaginous walls..... 1

1. Superficial mycelium often wide, with cells generally longer than broad..... Euantennariaceae

Superficial mycelium not so..... 2

2. Upper portion of pseudothecia and sterile tissue gelatinizing at maturity to expose the asci..... Englerulaceae

Small apical pore region of pseudothecia gelatinizing at maturity..... Parodiopsidaceae

More detailed information on Capnodiaceae and Euantennariceae is found in the excellent studies on New Zealand sooty moulds by Hughes (1970, 1972, 1974, 1976).

Capnodiaceae (Sacc.) Theiss. & Sydow

Hyphae generally narrow, conspicuous, dark, with mucilaginous walls. Pseudothecia more or less columnar, stalked or lobed with locules formed singly in the ends of the lobes, opening by gelatinization at the apical pore. Ascospores hyaline to brown, multiseptate or dictyoseptate. Anamorph when present is pycnidial.

Key to genera of Capnodiaceae with anamorphs

Ascospores hyaline..... *Aithaloderma*

Ascospores brown at maturity..... 1

1. Ascospores dictyoseptate..... *Capnodium*

Ascospores transversely multiseptate..... 2

2. Pseudothecia setose, barely stalked..... *Phragmocapnias*

Pseudothecia smooth with long sterile base..... *Scorias*

AITHALODERMA H. & P. Sydow, *Annls mycol.* **11**: 257, 1913.

Phaeochaetia Bat. & Cif., *Sydowia Beih.* **3**: 67, 1962.

Type sp.: *A. clavatisporum* H. & P. Sydow, *Annls mycol.* **11**: 257, 1913. Anamorph: Pycnidial state (Hughes, 1976).

Hughes (1976) has discussed the history and taxonomy of this genus. In the hyphae the species are similar to those of Capnodiaceae with conspicuous mucilaginous walls and in the pycnidial state they show some initial similarity to *Phragmocapnias* in the early stages of their development.

Hyphae more or less cylindrical, flexuous or straight, septate, constricted at the septa, smooth to rough-walled, pale brown to brown, with somewhat mucilaginous walls, often forming strands and an open network by mostly right angled branching and fusion of hyphal cells. Ascostromata pale brown to brown, hemispherical and setose or flattened and non setose, sometimes both kinds present in the same species, ostiolate at maturity or opening by an irregular radial fissure; for the most part the wall is composed of slightly pigmented, rounded cells but around the base it is formed of parts of the original network and radiating hyphae. The inner layers are made up of cells with mucilaginous walls. Asci 4-8 spored. Ascospores clavate, hyaline, 3 or more septate, at first not constricted at the septa but later deeply constricted.

Pycnidia arise symphogenously, superficial or partially below the mycelial hyphae. Superficial pycnidia subglobose, non setose, with an ostiole fringed with the ends of the wall hyphae. Partially immersed pycnidia subconical, larger than the superficial pycnidia, setose. Conidia hyaline, minute, ellipsoidal, one celled.

Key to species of Aithaloderma with anamorphs

Ascospores 3 septate, 20-24 × 3.5-5 μm..... *A. capense*
Ascospores 3-4 septate, 16.5-23 × 3-6 μm..... *A. setosum*
Ascospores 4 septate, 24-26 × 4-5 μm..... *A. viride*
Ascospores 3-5 septate, 24-26 × 5-6 μm..... *A. clavatisporum*
Ascospores 5-7 septate, 25-28 × 5-6 μm..... *A. ferrugineum*

A. capense Doidge, *Bothalia* **2:** 239, 1927.

Chaetothyrium capense (Doidge) Hansf. in Doidge, *Bothalia* **5:** 192, 1950.
Phaeochaetia capense (Doidge) Bat. & Cif., *Sydowia Beih.* **3:** 66, 1962.

Hyphae conspicuously roughened and straight. Ascostromata of both kinds, hemispherical and setose, flattened and non setose. The flattened ascostroma has a conspicuous radiating wall and opens by radial fissure. Asci 30-37 × 10-12 μm. Ascospores hyaline, subclavate, 3 septate, slightly constricted at the septa, 20-24 × 3.5-5 μm.

Pycnidia subglobose, non setose, minute. Conidia one celled, hyaline, ellipsoidal, minute.

On *Schotia latifolia*. South Africa.

A. clavatisporum H. & P. Sydow, *Annls mycol.* **11:** 257, 1913.

Chaetothyrium clavatisporum (H. & P. Sydow) Hansf., *Mycol. Pap.* **15:** 150, 1946.
Phaeochaetia clavatispora (H. & P. Sydow) Bat. & Cif., *Sydowia Beih.* **3:** 67, 1962.

Hyphae smooth-walled, more or less flexuous, pelliculose. Ascostromata setose, ostiolate at maturity. Asci 30-36 × 14-20 μm. Ascospores clavate, 3-5 septate, initially not constricted at the septa, later deeply constricted, hyaline, 24-26 × 5-6 μm.

Pycnidia of both kinds. Conidia hyaline, guttulate, 3.5-5 × 2 μm.

On *Psidium guajava*. Philippines.

A. ferrugineum Fraser, *Proc. Linn. Soc. N.S.W.* **60:** 98, 1935 (as '**ferruginea**').

Hyphae rough-walled and more or less flexuous. Ascostromata setose similar to that of *A. clavatisporum*. Asci cylindrical or oblong, 60-75 × 10-15 μm. Ascospores mostly 5 septate, occasionally 6-7 septate, constricted at the septa, 25-28 × 5-6 μm.

Pycnidia of both kinds. Conidia one celled, ovoid, 5-6 × 3 μm.

On *Breynia, Bursaria, Callistemon, Ceratopetalum, Cryptocarya, Citrus, Doryphora, Elaeodendron, Eugenia, Ficus, Monotoca, Pittosporum, Rapanea, Synoum.* Australia.

Fraser (1935a) has described and illustrated the structure and development of this species in detail.

A. setosum (Zimmermann) Boedijn, *Bull. Jard. Bot. Buitenz.* **11:** 227, 1931.

Antennaria setosa Zimmermann, *Centralbl. Bakt.* **8:** 151, 1902.
Limacinia setosa (Zimmermann) Sacc. & D. Sacc., *Syll. Fung.* **17:** 557, 1905.
Capnodium guajavae Bernard, *Bull. Dept. Agric. Ind. Néerl.* **11:** 21, 1907.
Limacinia guajavae (Bernard) Sacc. & Trotter, *Syll. Fung.* **22:** 63, 1913.
Aithaloderma longisetosum H. & P. Sydow, *Annls mycol.* **12:** 545, 1914.
Hypocapnodium setosum (Zimmermann) Speg., *Physis* **4:** 287, 1918.
Chaetothyrium setosum (Zimmermann) Hansf., *Reinwardtia* **3:** 113, 1954.
Phaeochaetia setosa (Zimmermann) Bat. & Cif., *Sydowia Beih.* **3:** 75, 1962.

Asci broadly elliptical, 40-54 × 12.5-16.5 μm. Ascospores 3-4 septate, elongate elliptic, tapering towards the base, apex bluntly rounded, 16.5-23 × 3-6 μm.

Pycnidia setose. Conidia elliptic, one celled, 3-4 × 1.5 μm.

On *Adiantum, Anacardium, Artocarpus, Chrysophyllum, Citrus, Coffea, Cupania, Elaeocarpus, Euphorbia, Hydrangea, Mangifera, Manilkara, Mimusops, Morus, Murraya, Philodendron, Psidium, Saccharum, Tachia, Tetracera, Xylopia.*

A. viride Fraser, *Proc. Linn. Soc. N.S.W.* **60:** 99, 1935 (as '**viridis**')

Hyphae rough-walled and flexuous. Ascostromata smooth, with an upper wall of radiating hyphae developed below a network of hyphae as in the flattened ascostroma of *A. capense*. Asci clavate, 50-70 × 17-20 μm, 4 or 8 spored. Ascospores 4 septate, constricted at the septa, 24-26 × 4-5 μm.

Pycnidia radiate, smooth, opening by a radiate fissure. Conidia one celled, 4-5 × 1 μm.

On *Elaeodendron*. Australia.

Fraser (1935a) has described in detail the development of this species.

CAPNODIUM Mont., *Ann. Sci. Nat. Bot. ser. 3,* **11:** 233, 1849.

Type sp.: *C. salicinum* Mont., *Ann. Sci. Nat. Bot. ser.* 3, **11:** 234, 1849.

Anamorph: *Fumagospora* Arnaud, *Phaeoxyphiella* Bat. & Cif., and *Scolecoxyphium* Cif. & Bat.

Colonies superficial composed of a loose or dense network of pale brown repent hyphae or a thick pseudoparenchymatous stroma. Ascostromata black, more or less globose to ellipsoid, shortly stalked or sessile, lobed with locules found singly in the ends of the lobes, glabrous, ostiolate at maturity, scattered or in groups. Asci 8 spored. Ascospores brown, transversely multiseptate with one or more vertical septa or without vertical septa.

Key to species of Capnodium with anamorphs

Ascospores transversely 3 septate with or without vertical septa..... 1

Ascospores transversely 5-6 septate, anamorph *Scolecoxyphium*..... *C. annonae*

1. Ascospores with one or more vertical septum, anamorph *Fumagospora*..... *C. salicinum*

Ascospores without vertical septa, pycnidial state *Phaeoxyphiella*..... *C. walteri*

Capnodium annonae Pat., *Bull. Soc. mycol. Fr.* **20:** 135, 1904 (as **anonae**).

Anamorph: *Scolecoxyphium* sp.

Mycelium epiphyllous, black, composed of mucilaginous, brown, branched, torulose to articulate hyphae of variable shape. Ascostromata 100-200 × 150-250 μm with the stalk up to 200 μm long. Asci clavate to ovoid, 40-60 × 20-25 μm. Ascospores ellipsoid clavate, hyaline at first, later brown, with 5-6 transverse septa and one or more vertical septa, usually constricted at the median septum, distal half somewhat wider than the lower half, 22-35 × 7-12 μm.

Pycnidia irregularly cylindrical, short or long, straight or flexuous, ostiolate, very variable in size up to 1 mm long, and 45 μm wide, without any swelling to indicate the location of the pycnidial cavity; the wall is composed of linearly arranged, fused hyphae and at the apex around the ostiole the hyphae are brown and blunt and do not form a hyaline fringe of hairs. Conidia ellipsoid, hyaline, one-celled, 4.5-5 × 1.5-2 μm.

On *Aegiceras, Annona, Bursaria, Callistemon, Cassinia, Casuarina, Croton, Doryphora, Eugenia, Hakea, Leptospermum, Melaleuca, Psychotria, Synoum.* Australia, Gambier Islands (Pacific).

Hughes (1976) was unable to determine the connection between the ascostromata and pycnidia in natural substrata but Fraser (1935b) has connected these two states by cultural studies. Fraser (1935b) has also connected *Scolecoxyphium*-like pycnidia to *Capnodium annonae* var. *obscurum* Fraser which has smaller ascostromata and shorter and stouter pycnidia.

Capnodium salicinum Mont., *Ann. Sc. Nat. ser.* 3, **11:** 234, 1849 (Fig. 2).

Polychaeton salicinum (Mont.). Kuntze, *Rev. Gen. Pl.* **1:** 13, 1891.

Anamorph: *Fumagospora capnodioides* Arnaud, *Annls Éc. natn. Agric. Montpellier, ser.* 2, **10:** 327, 1911.

Superficial mycelium membranous, composed of brown, branched, septate hyphae. Ascostromata up to 350 μm high and 200 μm broad. Asci obovoid, 40-75 × 20-27 μm. Ascospores conglobate in the ascus, cylindric clavate to obovoid, transversely 3 septate with one vertical septum in some of the cells, 20-26 × 8-14 μm.

Pycnidia elongated, short or long-stalked, flask-shaped, cylindrical or subulate, with a tapered long narrow neck terminating in an ostiole surrounded by a fringe of hyaline, tapered hyphal extensions. Conidia blastic in origin, with a slightly raised flat scar when young, initially hyaline and one celled, finally brown and transversely 2-5 (mostly 3) septate, with one to all of the cells with vertical septa, 11-24 × 5-11 μm.

The ascostromata and pycnidia occur frequently together intimately associated on the same stroma and there is little doubt of their connection (Hughes, 1976).

On *Bursaria, Castanospermum, Casuarina, Epacris, Leptospermum, Pittosporum, Salix, Syncarpia, Ulmus.* Australia, Hungary, France, U.S.S.R.

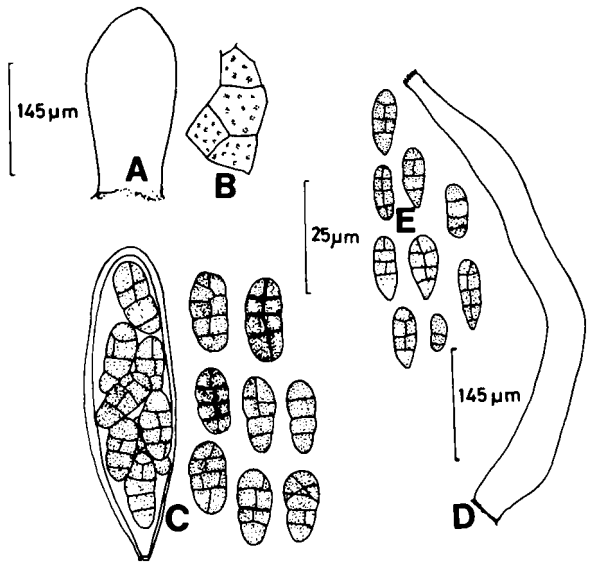


Fig. 2. *Capnodium salicinum*. A, pseudothecium; B, portion of pseudothecial wall; C, ascus and ascospores; D, pycnidium; E, conidia.

Capnodium walteri Sacc., *Hedwigia* **32:** 58, 1893 (Fig. 3).

Leptocapnodium walteri (Sacc.) Bat. & Cif., *Saccardoa* **2:** 125, 1963.
Phaeoxyphiella morototoni Bat. & Cif., *Quaderno* **31:** 149, 1963.
Phaeoxyphiella bahiensis Bat. & Matta in Bat. & Cif., *Quaderno* **31:** 146, 1963.
Phaeoxyphiella fisheri Bat. in Bat. & Cif., *Quaderno* **31:** 148, 1963.
Phaeoxyphiella walteri Bat., Nasc. & Cif. in Bat. & Cif., *Quaderno* **31:** 152, 1963.

Mycelium superficial, brown to black. Ascostromata 70-100 × 100-130 µm. Asci clavate, 50-60 × 10-15 µm. Ascospores fusiform to clavate, transversely 3 septate, dark brown, 22-26 × 7-9 µm.

Pycnidia superficial, flask shaped, barely stalked with a cylindrical to tapered neck terminating in an ostiole surrounded by blunt hyphal ends, up to 400 µm high. Conidia fusiform, straight or sometimes variously curved, reddish brown to brown, transversely 7-18 (typically 15) septate, 60-88 × 7-9 µm, with an acute apex and a narrow flat basal scar, rarely one vertical septum may develop in one or two cells.

Saccardo (1893) has described a 'spermogonial' state with hyaline, oblong conidia measuring 5 × 2 µm for this species.

On *Alphitonia, Bursaria, Callistemon, Casuarina, Doryphora, Epacris,*

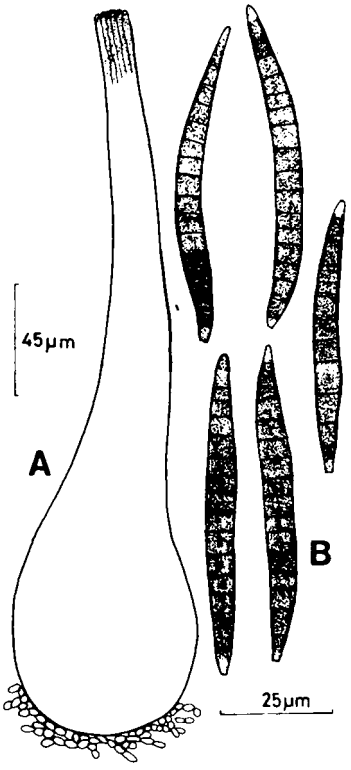


Fig. 3. *Capnodium walteri.* Pycnidium and conidia.

Eugenia, Leptospermum Melaleuca, Pittosporum, Ratonia. Australia. Fraser (1935b) and Yamamoto (1954, 55) have verified the connection between ascostromata and pycnidia by cultural methods.

PHRAGMOCAPNIAS Theiss. & H. Sydow, *Annls mycol.* **15:** 480, 1918(1917).

Trichomerium Speg., *Physis* **4:** 284, 1918.
Chaetoscorias Yamamoto, *Papers dedicated to Prof. Y. Tochinai & Prof. T. Fukushi* in Commemoration of their 60th Birthdays : 56, 1955.

Type sp. *P. betle* (H. & P. Sydow & Butler) Theiss. & H. Sydow, *Annls mycol.* **15:** 480, 1918(1917).

Anamorph: *Conidiocarpus* Woronichin

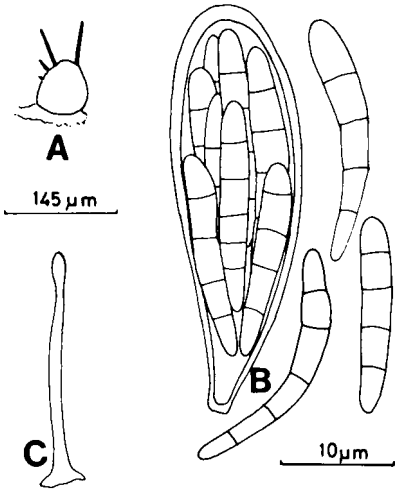


Fig. 4. *Phragmocapnias betle*. A, pseudothecium; B, ascus and ascospores; C, pycnidium.

Hughes (1976) recognised four species but Bat. & Cif. (1963) included several other species in this genus. This genus was established for the brown-spored type of *Limacinia* in the sense of Theissen & Sydow.

P. betle (H. & P. Sydow & E. Butler) Theiss. & H. Sydow, *Annls mycol.* **15:** 480, 1918(1917). (Fig. 4).

Capnodium betle H. & P. Sydow & E. Butler, *Annls mycol.* **9:** 384, 1911.

Anamorph: *Conidiocarpus* sp. (Hughes, 1976).

Colonies thin, amphigenous, black, pelliculose, composed of reticulately branched, dense, cylindrical to somewhat constricted, radiating hyphae. Pseudothecia scattered, black, subglobose to broadly ellipsoidal, up to 100 µm broad, barely stalked, firmly attached on the radiating basal hyphae, dark brown, thick-walled, ostiolate at maturity, with up to five dark brown, thick-walled, straight or curved, subulate, non septate, 50-100 µm long, 7-8 µm thick setae with blunt apices scattered over the pseudothecium. The wall is composed of pale to dark brown polygonal cells. Asci broadly clavate, 8 spored, 35-45 × 12-15 µm. Ascospores narrowly clavate, 4-6 septate, hyaline to brown at maturity, 21.5-25 × 4-5 µm.

Pycnidia long-stalked, 500-700 μm long without a neck, stalk composed of closely adpressed synnematous hyphae and the swollen part indicating the site of the pycnidial cavity. Conidia hyaline, oblong, one celled, guttulate, 4-10 × 2-4 μm.

Conidiocarpus pycnidia are often attached to the same hyphae that bear the pseudothecia of *P. betle* and they are frequently found on sooty moulds in the tropics and subtropics. *Conidiocarpus* pycnidia can be distinguished from those of *Polychaeton* by the stalk which is composed of closely adpressed synnematous hyphae and by the distinct swelling which indicates the site of the pycnidial cavity.

On leaves of *Piper betle*. Bangladesh, Burma.

SCORIAS Fr., *Syst. Orb. Veg.* **1:** 171, 1825.

Neocapnodium Yamamoto, *Annls. Phytopath. Soc. Japan* **19:** 1, 1955.
Leptocapnodium (Arnaud) Cif. & Bat. in Bat. & Cif. *Saccardoa* **2:** 121, 1963.

Type sp: *S. spongiosa* (Schwein.) Fr., *Syst. mycol.* **3:** 291, 1832.

Anamorphs: Pycnidial states belonging to *Polychaeton* (Pers.) Lév., *Conidiocarpus* Woronichin and *Scolecoxyphium* Cif. & Bat. have been found associated with pseudothecia (Hughes, 1976).

Subiculum massive, sponge-like, centrally straw-coloured to black composed of cylindric brown hyphae united into branching strands, each surrounded by a gelatinous sheath. Pseudothecia and pycnidia develop over the surface of the sterile mycelium. Pseudothecia black, crowded, vertically elongated with a long sterile base, subglobose to broadly ellipsoidal with a rounded apex. The wall is thin and smooth. Asci oblong to saccate. Ascospores hyaline to olivaceous brown, more or less clavate, multiseptate not or slightly constricted at the primary septum, smooth or finely roughened at maturity.

S. spongiosa (Schwein.) Fr., *Syst. mycol.* **3:** 291, 1832 (Fig. 5).

Botrytis spongiosa Schwein., *Schriften Naturf. Ges. Leipzig* **1:** 101, 1822.

Anamorph: *Polychaeton* sp. (Hughes, 1976).
Pseudothecia up to 84 μm broad, sterile base up to 200 μm long.

Asci 38-50 × 10-13 μm. Ascospores 3 septate, finely roughened at maturity, 13-15 × 3.5-4.5 μm with the upper cells slightly wider than the lower cells.

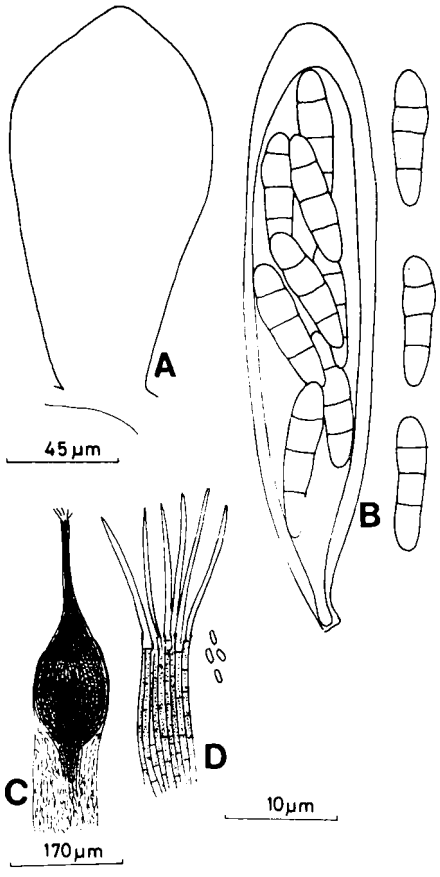


Fig. 5. *Scorias spongiosa*. A, pseudothecium; B, ascus and ascospores; C, pycnidium; D, neck of pycnidium and conidia.

Pycnidia up to 50 µm broad tapering to an elongate apex up to 200 µm long and 18 µm wide. Conidia minute, 0.5-1 µm long, hyaline, one celled.

On leaves and branches of *Fagus*. Europe and U.S.A.

Yamamoto (1954) described two species of *Scorias, S. communis* and *S. cylindrica* which do not form a sponge-like subiculum, but the pseudothecia are stalked with hyaline to olivaceous ascospores. According to his illustrations *S. communis* produces *Conidiocarpus* pycnidia and *S. cylindrica* forms *Scolecoxyphium* pycnidia which he verified by single spore isolations (Hughes, 1976). *Neocapnodium tana-*

kae (Shirai & Hara) Yamamoto (1957) was described as having pseudothecia borne terminally on branched stalks with hyaline to olivaceous or rarely brown, 3 septate ascospores and the pycnidia illustrated are the *Polychaeton* type. The connection between the anamorph and teleomorph was verified by Yamamoto by single spore isolations. This species belongs in *Scorias* and is therefore transferred as *S. tanakae* (Shirai & Hara) comb. nov.

According to Reynolds (1971) *Capnodium brasiliense* Puttemans is *Scorias* and that *S. paulensis* Henn., *S. philippinensis* Mendoza and *S. cylindrica* are all very similar to *C. brasiliense*. *S. philippinensis* and *S. cylindrica* have a *Scolecoxyphium* anamorph.

Englerulaceae Henn.

Superficial mycelium with or without hyphopodia. Pseudothecia more or less globose, upper portion of pseudothecia and sterile tissues gelatinizing at maturity to expose the asci. Ascospores one septate.

Anamorphs: *Periconiella* Sacc., *Capnodiastrum* Speg., *Mitteriella* H. Sydow and *Sarcinella* Sacc.

Key to genera of Englerulaceae with anamorphs

Superficial mycelium non hyphopodiate, anamorph *Periconiella*..... ..... *Allosoma*

Superficial mycelium hyphopodiate..... 1

1. Mycelium thin and delicate, pseudothecia with a narrow pseudoparenchymatic base, anamorph *Capnodiastrum*..... *Rhytidenglerula*

   Mycelium stout and thick-walled, pseudothecia with a flattened base, anamorph *Mitteriella* and/or *Sarcinella*..... *Schiffnerula*

ALLOSOMA H. Sydow, *Annls mycol.* **24:** 353, 1926.

This is a monotypic genus.

A. cestri H. Sydow, *Annls mycol.* **24:** 353, 1926 (Fig. 6).

Anamorph: *Periconiella cestri* (H. Sydow) M. B. Ellis, *Mycol. Pap.* **111:** 29, 1967.

Acrodesmis cestri H. Sydow, *Annls mycol.* **24:** 424, 1926.

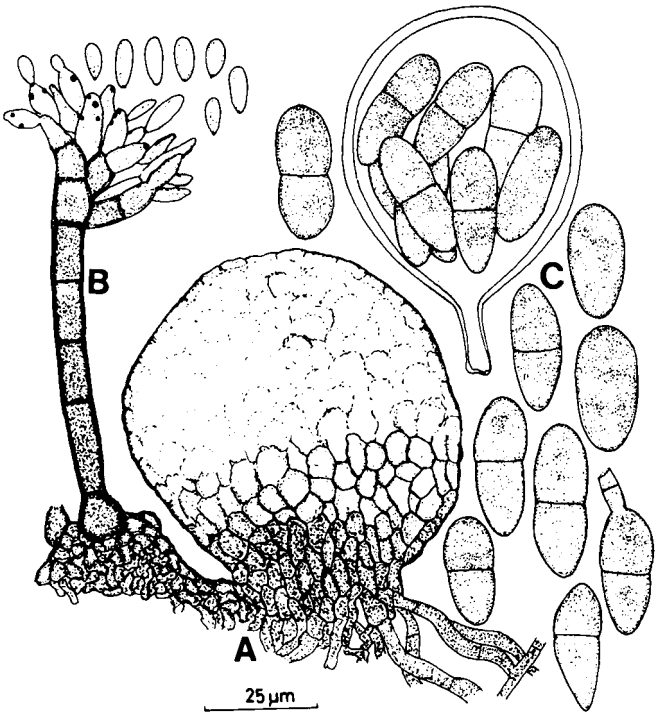


Fig. 6. *Allosoma cestri* (type). A, pseudothecium; B, conidiophore and conidia; C, ascus and ascospores.

The teleomorph and the anamorph are closely associated and connected by the same mycelium.

Colonies hypophyllous, effused, grey to black, with short hairs. Superficial mycelium composed of a network or irregularly branched, anastomosing, septate hyphae. Pseudothecia hypophyllous, subglobose, narrowing to a short basal stalk, seated singly or in small groups on a flat stroma formed by superficial mycelium, up to 225 µm broad and 150 µm high. The pseudothecial wall is composed of several layers of small polygonal to irregular cells. The upper part of the pseudothecial wall and the sterile tissues disintegrate into a slimy mass exposing the asci at maturity. Asci few, ovoid to subglobose, stalked or sessile, 3-8 spored, 40-75 × 32-60 µm. Ascospores conglobate, oblong ellipsoid, 0-1 (mostly one) septate, brown, constricted, 25-32 × 10-14 µm.

Conidiophores arising singly or in groups terminally or laterally on the hyphae and from plates of stromatic cells. Each conidiophore consists

of a stipe and a complex head of branches bearing conidia. The stipe is erect, straight or flexuous, cylindrical, septate, smooth, dark brown, paler near the apex, up to 350 μm long, 5-12 μm thick, sometimes with a swollen base. Primary branches bearing branchlets, cylindrical or subulate, straight or flexuous, pale olivaceous brown to brown, up to 60 μm long, 3-8 μm thick with conidial scars towards the apex. Secondary and tertiary branches hyaline to pale olivaceous. Conidiogenous cells polyblastic, integrated, terminal on stipe and branches, sympodial, cylindrical, cicatrized, with numerous scars. Conidia borne terminally and laterally, single or in short sometimes branched chains, cylindrical, elliptical or fusiform, one celled, smooth, pale olivaceous brown, 8-17 × 3-6 μm.

On leaves of *Cestrum macrophyllum*. Costa Rica.

RHYTIDENGLERULA Höhnel, *Sber. Akad. Wiss. Wien* **127:** 386, 1918.

Dialacenium H. Sydow, *Annls mycol.* **28:** 158, 1930.
Englerulella Hansf., *Proc. Linn. Soc. Lond.* **157:** 163, 1946.

Type sp.: *R. carnea* (Ell. & Mart.) Höhnel, *Sber. Akad. Wiss. Wien* **127:** 386, 1918.

Anamorph: *Capnodiastrum* Speg. (= *Oothecium* Speg.)
About 10 species.

Colonies thin, hypophyllous, dark brown to black, scattered or often confluent, superficial, composed of septate, branched, radiate reticulate, hyphopodiate hyphae. Pseudothecia superficial on hyphae, depressed globose to obconical, glabrous, yellowish orange to brown, non-ostiolate, with a plane apex, becoming mucose diffluent from apex downwards with a thin wall of one layer composed of cells which become slimy and gelatinize above, the basal wall brown. Asci few, broadly clavate to subglobose, thickened above, aparaphysate, separated by a slimy mass or sometimes by hyphal elements, 8 spored. Ascospores hyaline becoming brown, oblong, ellipsoid, ovoid, septate in the middle, constricted at the septum, often with distinct hyaline area near each end and next to the septum, wall roughened.

R. tremae (H. Sydow) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 158, 1962 (Fig. 7)

Schiffnerula tremae H. Sydow, *Annls mycol.* **28:** 164, 1930.
Englerulella tremae (H. Sydow) Hansf., *Mycol. Pap.* **15:** 30, 1946.

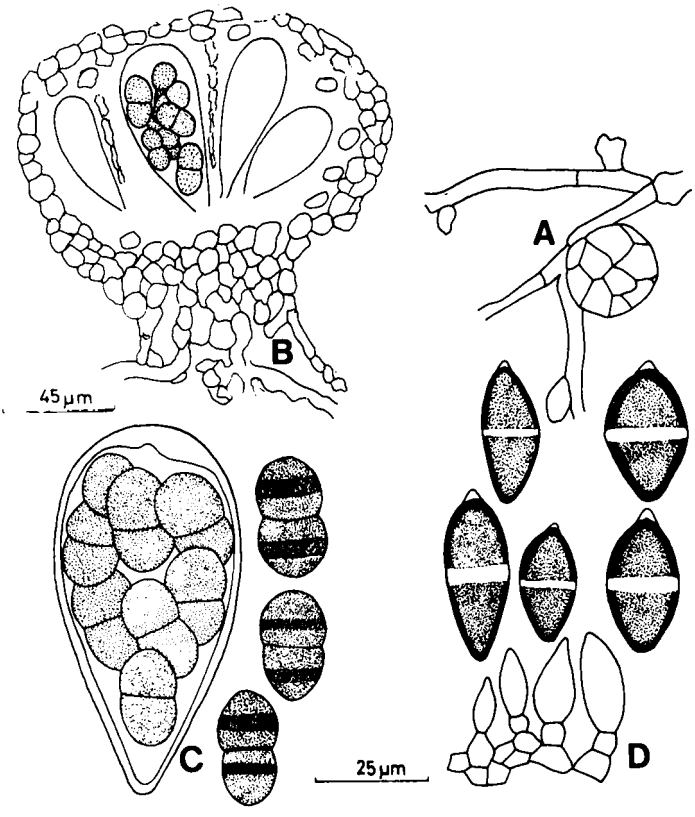


Fig. 7. *Rhytidenglerula tremae* (type). A, mycelia bearing a young pseudothecium; B, v.s. of pseudothecium; C, ascus and ascospores; D, conidiophores and conidia.

Englerulella ugandensis Hansf., *Proc. Linn. Soc. Lond.* **157:** 165, 1946.
Schiffnerula clemensiae Petrak, *Sydowia* **9:** 535, 1955.

Anamorph: *Capnodiastrum stylosporum* (Cooke) Petrak, *Sydowia* **6:** 341, 1952.

Asterina stylospora Cooke, *Grevillea* **10:** 129, 1882.
Oothecium consimile H. Sydow, *Annls mycol.* **28:** 443, 1930.
Oothecium tremae H. Sydow, *Annls mycol.* **28:** 195, 1930.
Oothecium stylosporum (Cooke) Doidge, *Bothalia* **4:** 327, 1942.
Capnodiastrum tremae (H. Sydow) Petrak, *Sydowia* **6:** 341, 1952.

Colonies up to 3 mm diam., more or less rounded, becoming confluent. Hyphae up to 6 µm thick. Hyphopodia alternate, septate, up to 32 µm

diam., upper cell broadly clavate with rounded to flattened apex, lower cell straight to curved, more or less cylindrical. Pseudothecia up to 150 μm broad. Asci 50-60 × 25-30 μm. Ascospores 20-28 × 12-15 μm, with distinct hyaline areas near each end and next to the septum.

Pycnidia numerous among superficial mycelia, often crowded, up to 100 μm broad, non ostiolate. The membranous wall is composed of polygonal, pellucid, olivaceous brown cells which break down at maturity from the apex downwards by mucilaginous histolysis. Conidiogenous cells holoblastic, lageniform or doliiform, hyaline, simple. Conidia dark olivaceous brown to olivaceous brown, variable in form, mostly ovoid to oblong, sometimes pyriform, ellipsoidal or subglobose, with a distinct hyaline central band, broadly rounded above with a hyaline to pale olivaceous apical appendage up to 3 μm long, base more or less tapered or truncate, 15-30 × 8-15 μm.

On leaves of *Trema* spp. Africa, Asia, South America.

SCHIFFNERULA Höhnel, *Sber. Akad. Wiss. Wien* **118:** 867, 1909.

Phaeoschiffnerula Theiss., *Broteria* **12:** 21, 1914.
Questieria Arnaud, *Les Astérinées* **1:** 186, 1918.
Diathrypton H. Sydow, *Philipp. J. Sci.* **21:** 137, 1922.
Coniosporiella Bat. in Bat., Maia & Bezerra, *Atas. Inst. Univ. Recife* **3:** 113, 1966.

Type sp.: *S. mirabilis* Höhnel, *Sber. Akad. Wiss. Wien* **118:** 868, 1909.

Anamorphs: *Mitteriella* H. Sydow and *Sarcinella* Sacc. (Ellis, 1971).
(For generic descriptions of these genera see under *Clypeolella*)

Foliicolous, superficial mycelium brown, amphigenous hyphopodiate, non setose, often with *Sarcinella* and *Mitteriella* anamorphs, forming haustoria singly from hyphopodia in the epidermal cells of the host. Pseudothecia superficial on external mycelium, globose, at first with a thin pseudoparenchymatous wall which early becomes mucose diffluent, sessile, non ostiolate. Asci few, aparaphysate, broadly ellipsoidal to subglobose, sessile, 8 spored, thickened above. Ascospores one septate, brown when mature, usually ripening in succession, conglobate inside the ascus.

The pseudothecial initial is radiate and until diffluence begins it looks rather like the initial of an *Asterina,* but the radiate disc in *Schiffnerula* remains pale brown and is not differentiated to form a definite scutellum as in *Asterina* and related genera. The genus resembles *Clypeolella* in having similar types of anamorph but the pseudothecia are not

radiate, do not open by stellate fissure and do not develop beneath the hyphae as in *Clypeolella*.

About twenty species have been described and fifteen of them with *Mitteriella* and *Sarcinella* anamorphs (Hansford, 1946b, 1949; Müller & von Arx, 1962). The *Mitteriella* anamorph with falcate conidia is better placed in *Questieriella* Arn. which needs to be validated Hughes (1983) in *Can. J. Bot.* **61:** 1727-1767, has now validated *Questieriella* and has described and tabulated some species of *Schiffnerula* with *Sarcinella, Mitteriella* and *Questieriella* synanamorphs.

S. mirabilis Höhnel, *Sber. Akad. Wiss. Wien* **118:** 868, 1909 (Fig. 8).

S. pittieriana H. Sydow, *Annls mycol.* **28:** 161, 1930.
S. malabarensis Ramakr. & Sundar., *Proc.Ind.Acad.Sci.* **38:** 188, 1953.

Mycelium epiphyllous, seldom hypophyllous, composed of olive brown, indistinctly septate, loose, slightly undulate, branched, mostly radiating hyphopodiate, 6-8 μm thick hyphae. Hyphopodia numerous, alternate, rounded, one-celled, 9-13 × 7-10 μm, with a convex apex,

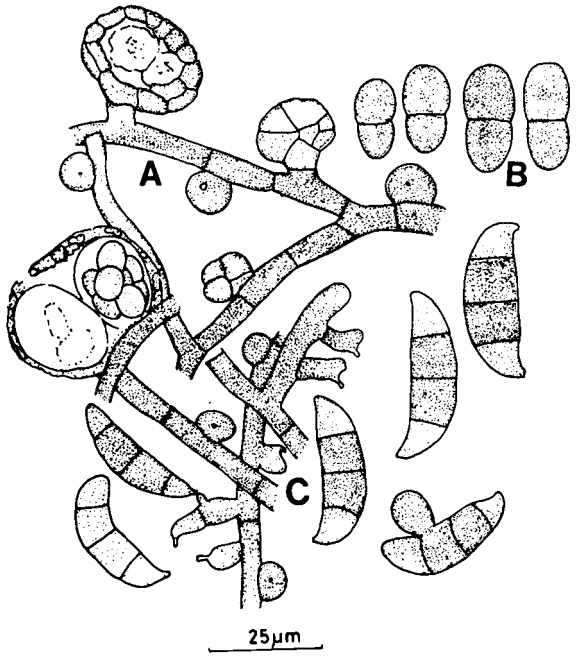


Fig. 8. *Schiffnerula mirabilis.* A, hyphae bearing pseudothecia; B, ascospores; C, conidiophores; D, *Mitteriella* conidia.

sometimes with a concave depression. *Mitteriella* conidia arise from short, cylindrical to clavate, denticulate conidiophores. Conidia 3 septate, brown with paler end cells, 35-44 × 9-14 μm, falcate.

Pseudothecia on the sides of hyphae or apical on short lateral branches, 20-40 μm broad. Asci 1-3, broadly elliptical to globose, thick-walled, 8 spored, 24-38 × 20-30 μm. Ascospores conglomerate, oblong, broadly rounded at the ends, often slightly tapering at the base, olivaceous brown when mature, septate in the middle, straight, 20-27 × 9-13.5 μm.

On *Passifora* spp. and *Adenia lobata*. Africa, Asia, S. America.

Other species described with anamorphs are briefly mentioned below.

S. cissi Hansf., *Proc. Linn. Soc. Lond.* **157:** 160, 1946.

Pseudothecia 40-50 μm broad. Asci 40-50 × 35-40 μm. Ascospores 18-21 × 8-10 μm. Conidia falcate, 3 septate, 35-45 × 11-13 μm.

On *Rhoicissus revoillii*. Uganda.

S. doidgeae Hansf., *Proc. Linn. Soc. Lond.* **157:** 161, 1946.

Pseudothecia up to 50 μm broad. Asci 35-50 × 25-30 μm. Ascospores 20-22 × 8-10 μm. Conidia falcate, 3 septate, 30-35 × 8-10 μm.

On *Cynanchum, Secamone, Tylophora*. S. Africa.

S. fici Sahni, *Mycopath. Mycol. App.* **23:** 334, 1964.

Pseudothecia up to 170 μm broad. Asci 40-44 × 23-27 μm. Ascospores 16-23.5 × 10-12 μm. Conidia 3 septate, 35-49 × 9-11 μm. *Sarcinella* conidia up to 34 μm diam.

On *Ficus infectoria*. India.

S. gymnosporiae Hansf., *Proc.Linn.Soc.Lond.* **157:** 159, 1946.

Pseudothecia up to 60 μm broad. Asci 30-35 × 20-25 μm. Ascospores 20-23 × 10-12 μm. Conidia falcate, 3 septate, 30-33 × 10-11 μm.

On *Gymnosporia buxifolia, G. nemorae*. S. Africa.

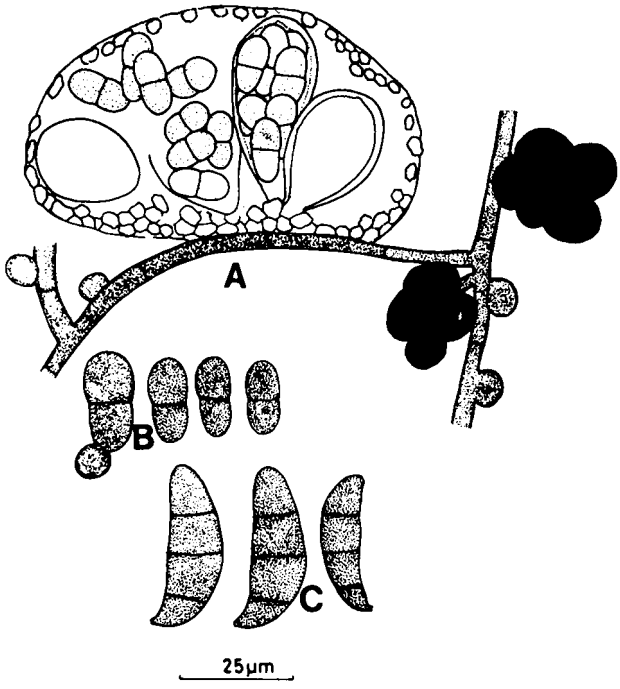


Fig. 9. *Schiffnerula rhois* (type). A, v.s. pseudothecium and hyphae bearing *Sarcinella* conidia; B, ascospores; C, *Mitteriella* conidia.

S. rhois Hansf., *Proc.Linn.Soc.Lond.* **157:** 161, 1946 (Fig. 9).

Pseudothecia up to 100 µm broad. Asci 40-50 × 25-30 µm. Ascospores 18-20 (26) × 10-11 µm. Conidia falcate, 30-37 × 9-12 µm, 3 septate. *Sarcinella* conidia up to 30 µm broad.

On *Rhois villosa*. Uganda.

S. scopariae Hansf., *Proc.Linn.Soc.Lond.* **160:** 117, 1949.

Pseudothecia up to 150 µm broad. Asci 30-50 × 35-40 µm. Ascospores 17-19 × 7-9 µm. Conidia falcate, 3 septate, 28-35 × 7-9 µm. *Sarcinella* conidia up to 30 µm broad.

On *Scoparia dulcis*. Sierra Leone.

S. solani Hansf., *Proc.Linn.Soc.Lond.* **160:** 118, 1949.

Pseudothecia up to 75 μm broad. Asci 30-45 × 25-30 μm. Ascospores 16-20 × 7-9 μm. Conidia falcate, 3 septate, 28-35 × 8-11 μm. *Sarcinella* conidia up to 35 μm broad.

On *Solanum melongena*. Sierra Leone.

S. spigeliae Hansf., *Proc.Linn.Soc.Lond.* **160:** 117, 1949.

Pseudothecia up to 80 μm broad. Asci 30-40 × 25-30 μm. Ascospores immature. Conidia falcate, 3 septate, 25-32 × 8-10 μm.

On *Spigelia anthelmia*. Sierra Leone.

S. toddaliae Hansf., *Proc.Linn.Soc.Lond.* **153:** 13, 1941.

Pseudothecia up to 70 μm broad. Asci 35-45 × 30-40 μm. Ascospores 22-25 × 10-14 μm. Conidia falcate, 3 septate, 35-40 × 10-12 μm.

On *Toddalia asiatica*. Uganda.

S. viticis Hansf., *Proc.Linn.Soc.Lond.* **157:** 162, 1946.

Pseudothecia up to 65 μm broad. Asci 35-50 × 35-40 μm. Ascospores 22-26 × 10-13 μm. Conidia falcate, 3 septate, 35-40 × 8-11 μm.

On *Vitex fischeri*. Uganda.

S. whitfieldiae Hansf., *Proc.Linn.Soc.Lond.* **157:** 162, 1946.

Pseudothecia up to 60 μm broad. Asci 25-40 × 25-30 μm. Ascospores 18-23 × 8-9 μm. Conidia falcate, 3 septate, 30-41 × 9-10 μm.

On *Whitfieldia* spp. Uganda.

Euantennariaceae Hughes & Corlett

Hyphae superficial, usually brown to dark brown, often wide, cylindrical or more or less cylindrical, composed of cells generally longer than broad, forming a sparse network, a spongy subiculum or the hyphae may grow together synchronously to form a thallus one cell thick. Pseudothecia superficial, solitary with hyphal appendages. Ascospores brown, three or more septate or dictyoseptate, often mucronate at the ends.

Anamorphs: *Antennatula* with *Hormisciomyces* or *Trichothallus* with *Plokamidomyces.*

Key to genera of Euantennariaceae

Subiculum of cylindrical hyphae, anamorph *Antennatula* with *Hormisciomyces* ..... *Euantennaria*

Subiculum of branched cylindric hyphae that form a flattened thallus one cell thick, anamorph *Trichothallus* with *Plokamidomyces*..... *Trichopeltheca*

EUANTENNARIA Speg., *Boln Acad.nac.Cien.Côrdoba* **23:** 549, 1919.

Aithalomyces Woronichin, *Annls mycol* **24:** 149, 1926.
Phaeocapnias Cif. & Bat. in Bat. & Cif., *Saccardoa* **2:** 176, 1963.

Type sp.: *E. tropicicola* Speg., *ibid.* 1919.

Anamorphs: *Hormisciomyces* Bat. & Nascimento, phialidic, and *Antennatula* Fr., blastic phragmoconidial (Hughes, 1974).

Hyphae superficial, usually brown to dark brown, wide, septate, finely or coarsely roughened, cylindrical to more or less cylindrical, composed of cells generally longer than broad. Repent hyphae form irregular network, and upright branches are scattered or abundant to give the colony a velutinous appearance. Pseudothecia single, superficial with hyphal appendages. Asci 8 spored. Ascospores brown, multiseptate, often with mucronate paler ends.

Antennatula: Blastic phragmoconidia develop singly on a series of cells scattered on the hyphae as blown-out ends of the lateral wall, subhyaline, clavate with inconspicuous to distinct, subglobose to barrel-shaped swellings at the base when young, multiseptate when mature, pale brown to dark brown, fusiform, usually straight, sometimes slightly curved, some cells enlarged, bluntly mucronate at both ends or truncate at the base, which bears a flat scar through which the basal cell pro-

trudes in the form of a papilla. Conidia secede easily from the hyphae at maturity, many anastomose with hyphae and with other conidia and germinate terminally or laterally, or produce *Hormisciomyces* phialides.

Hormisciomyces: Hyphae coarsely roughened, euantennariaceous. Phialides borne in a whorl at the swollen ends of hyphal branches (phialophores) which arise as upright branches of repent hyphae. Phialides more or less spherical, with a short neck directed inwards. Phialoconidia subglobose, hyaline, minute and aggregated in a slimy head. Sometimes a phialophore may proliferate through a whorl of phialides to produce another whorl at a higher level.

Key to Euantennaria species

Ascospores 3 septate..... 1

Ascospores more than 3 septate..... 2

1. Ascospores 23-35.6 × 9-12.6(18) μm..... *E. rhododendri*

   Ascospores 30-39 × 12-18 μm..... *E. arctica*

2. Ascospores 3-6 septate, 30-54 × 10-15 μm..... *E. tropicicola*

   Ascospores often more than 5 septate..... 3

3. Ascospores not more than 9 septate..... 4

   Ascospores up to 13 septate..... 5

4. Ascospores 6-7 septate, 48-74 × 16-20 μm..... *E. caulicola*

   Ascospores 5-9 septate, 41-70 × 14.5-18 μm..... *E. mucronata*

5. Ascospores 11-13 septate, 90-135 × 17-28 μm..... *E. novae-zelandiae*
   Ascospores 5-12 septate, 36-100 × 12-20 μm..... *E. pacifica*

E. arctica (Woronichin) S. Hughes, *N.Z. Jl Bot.* **12:** 342, 1974.

Aithalomyces arctica Woronichin, *Annls mycol.* **24:** 149, 1926.
Limacinia arctica (Woronichin) Barr, *Can.J.Bot.* **39:** 210, 1961.
Morfea alaskensis (Sacc. & Scali) Bat. & Cif. var. *crassispora* Bat. & Cif., *Saccardoa* **2:** 143, 1963.

Pseudothecia up to 265 μm broad. Asci 70-100 × 33-48 μm. Ascospores 3 septate, 30-39 × 12-18 μm.

Antennatula conidia 7-9 septate, 53-63 × 10 μm (Woronichin, 1926). *Hormisciomyces* phialidic state was found on hyphae (Hughes, 1974).

On branches of *Phyllodoce taxifolia* (type), *Arctostaphylos uva-ursi,*

Empetrum nigrum, E. hermaphroditum, Cassiope spp. and *Calluna vulgaris*. Canada, Russia, Sweden, U.S.A.

E. caulicola S. Hughes, *N.Z.Jl Bot.* **12:** 324, 1974. (Fig. 10).

Anamorph: *Antennatula caulicola* (Bat. & Oliviera) S. Hughes, *N.Z.Jl Bot.* **12:** 324, 1974.
Hormisciella caulicola Bat. & Oliviera in Bat., *Ann.Soc.Biol.Pernamb.* **14:** 101, 1956.

Pseudothecia up to 350 μm broad. Asci 90-125 × 35-50 μm. Ascospores 6-7 septate, 48-74 × 16-20 μm, rarely with a vertical septum in one cell.

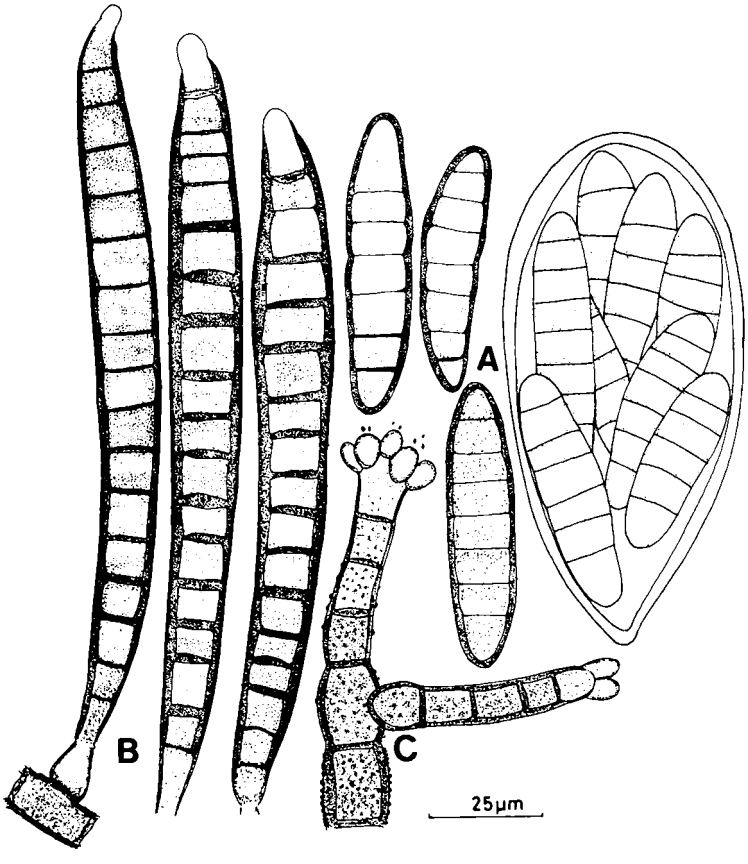


Fig. 10. *Euantennaria caulicola* (type). A, ascus and ascospores; B, *Antennatula* conidia; C, *Hormisciomyces* state.

Antennatula conidia with a subglobose basal swelling, variable in length, 8-19 (mostly 11-13) septate, 80-200 × 14-21.5 μm. *Hormisciomyces* phialides 4.5-6.3 μm diam. Phialoconidia hyaline, minute, aggregated in a slimy head.

On branches of *Coprosma* spp. (type) and common on leaves, twigs and trunks of various hosts (44) belonging to Pteridophytes, Gymnosperms and Angiosperms. Australia, New Zealand and Chile.

E. mucronata (Mont.) S. Hughes, *N.Z.Jl Bot.* **10:** 227, 1972 (Fig. 11).

Capnodium mucronatum Mont., *Ann. Sci. Nat.* **14:** 175, 1860.

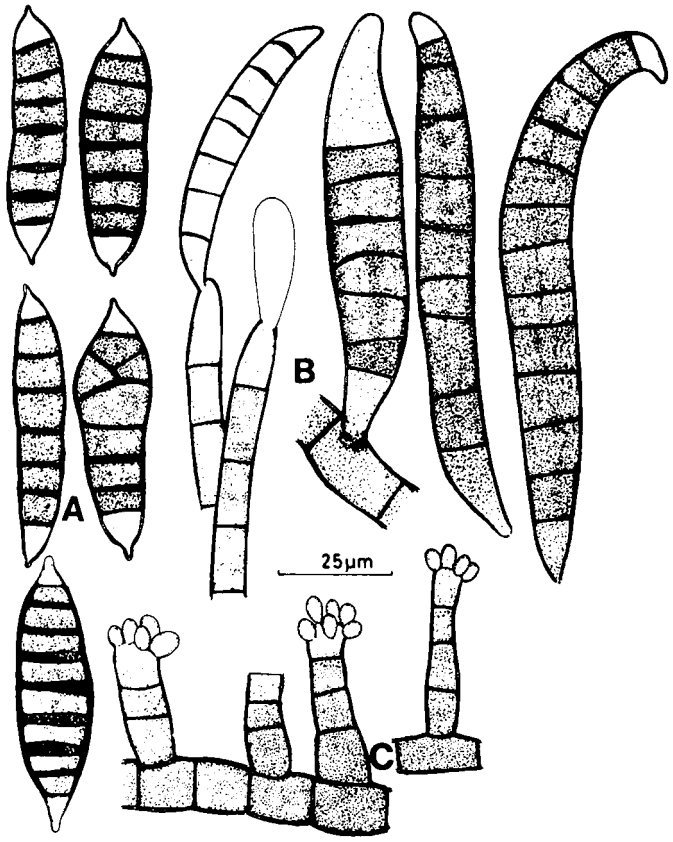


Fig. 11. *Euantennaria mucronata.* A, ascospores; B, *Antennatula* conidiophores and conidia; C, *Hormisciomyces* state.

Meliola mucronata (Mont.) Sacc., *Syll. Fung.* **1:** 62, 1882.
Limacinia mucronata (Mont.) Sacc. in Sacc. & Lindau, *Hedwigia* **36:** XX, 1897.
Morfea mucronata (Mont.) Maire, *Bull.Soc.Bot.Fr.* **56:** CCLXX, 1911.
Phaeocapnias mucronata (Mont.) Cif. & Bat. in Bat. & Cif., *Saccardoa* **2:** 176, 1963.

Antennatula Anamorph: *Podosporium grande* Cooke, *Grevillea* **12:** 11, 1883 (pro parte).

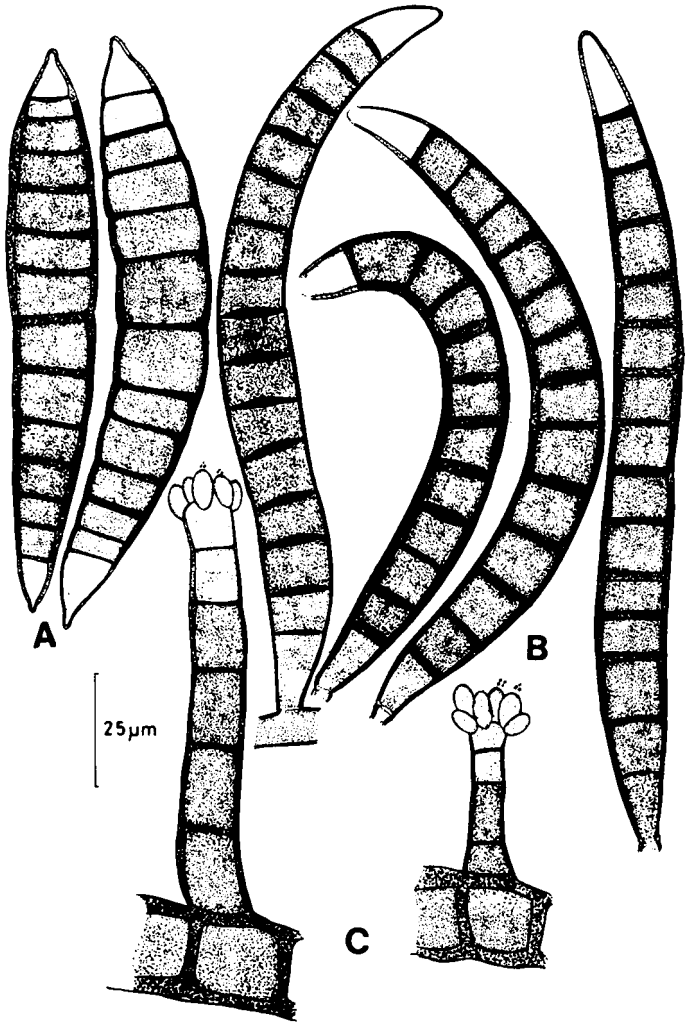


Fig. 12. *Euantennaria novae-zelandiae.* A, ascospores; B, *Antennatula* conidia; C, *Hormisciomyces* state.

Pseudothecia up to 450 μm broad. Asci 100-125 × 40-55 μm. Ascospores 5-9 (mostly 7) septate, 41-70 × 14.5-18 μm.

Antennatula conidia 7-15 (mostly 9-11) septate, 63-170 × 10.8-20 μm. *Hormisciomyces* phialides 7.2-9 × 4.5-5.5 μm. Phialoconidia 1.8-2.8 × 2 μm.

On *Weinmannia trichosperma* (type) and on thirty nine different host plants of Filicales, Gymnosperms and Angiosperms. Argentina, Chile, New Zealand (Hughes, 1974). This is the commonest sooty mould of the Southern Pacific Basin.

E. novae-zelandiae S. Hughes, *N.Z.Jl Bot.* **12:** 313, 1974 (Fig. 12).

Pseudothecia up to 400 μm broad. Asci 160-170 × 55-66 μm. Ascospores 11-13 septate, 90-135 × 17-28 μm.

Antennatula conidia variable in length and septation, up to 31 (mostly 11-15) septate, 95-460 × 16.5-21.5 μm. *Hormisciomyces* phialides 8-11 × 4.5-7.2 μm. Phialoconidia not seen.

On branches of *Coprosoma* spp. (type) and on leaves, twigs and trunks of ten different hosts of Gymnosperms and dicots. New Zealand (Hughes, 1974).

E. pacifica S. Hughes, *N.Z.Jl.Bot.* **12:** 318, 1974. (Fig. 13).

Pseudothecia up to 500 μm broad. Asci 100-135 × 43-47 μm. Ascospores 5-12 (mostly 7-9) septate, 36-100 × 12-20 μm.

Antennatula conidia generally smooth but sometimes finely roughened or striate 5-11 septate, 43-112 × 12.5-20 μm.

Hormisciomyces phialides 7.2-8 × 3.7-5.5 μm. Phialoconidia not seen.

On branches of *Carpodetus serratus* (type) and on twenty-two different hosts of Filicales and dicotyledons (Hughes, 1974). Australia, New Zealand and Chile.

E. rhododendri (Woronichin) S. Hughes, *N.Z.Jl Bot.* **12:** 344, 1974 (Fig. 14).

Aithalomyces rhododendri Woronichin, *Annls mycol.* **24:** 149, 1926.
? *Limacinia alaskensis* Sacc. & Scalia in Sacc., Peck & Trelease, *Cryptogamic Bot.* **5:** 34, 1910.
Euantennaria alaskensis (Sacc. & Scalia) Speg., *Physis* **4:** 284, 1918. (as *alascaensis*).

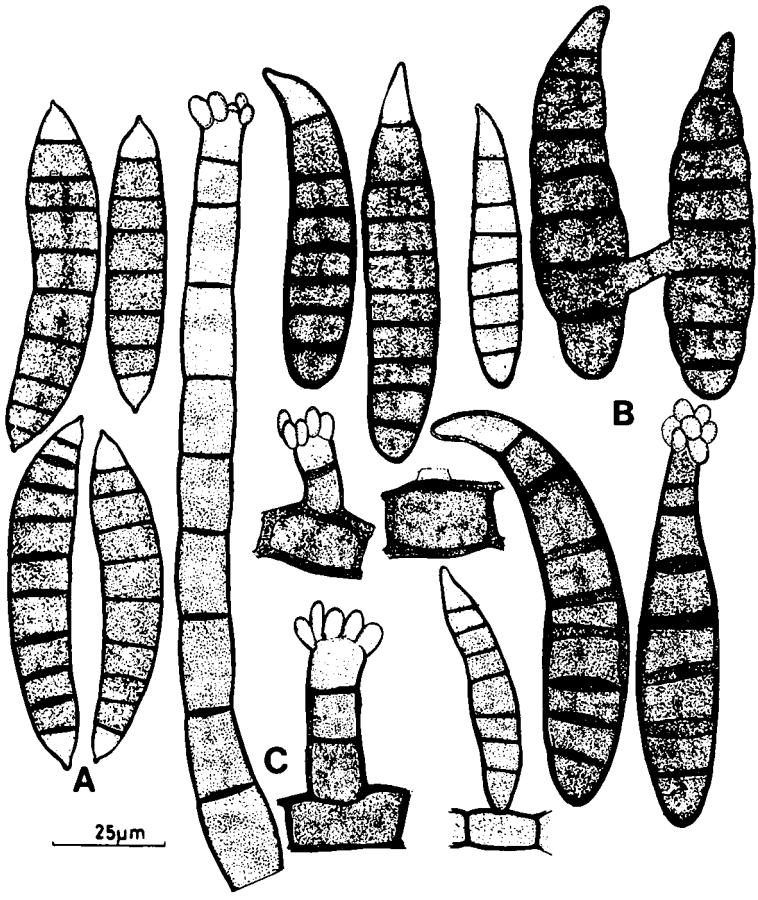


Fig. 13. *Euantennaria pacifica.* A, ascospores; B, *Antennatula* conidia; C, *Hormisciomyces* state.

Morfea alaskensis (Sacc. & Scalia) Bat. & Cif., *Saccardoa* **2:** 142, 1963.
Aithalomyces alaskensis (Sacc. & Scalia) Barr, *Contr. Univ. Michigan Herb.* **9:** 621, 1972.

Pseudothecia up to 200 µm broad. Asci 48-120 × 15-36 µm. Ascospores 3 septate, 23-35.6 × 9-12.6(18) µm.

No *Antennatula* conidia present. *Hormisciomyces* conidiophores were frequently present on pseudothecial initials.

On branches of *Betula nana, Juniperus* and *Rhododendron chrysantum* (type). Russia and Sweden.

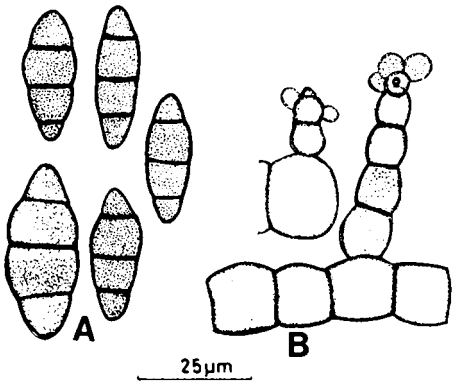


Fig. 14. *Euantennaria rhododendri.* A, ascospores; B, *Hormisciomyces* state.

E. tropicicola Speg., *Boln Acad.nac.Cien.Côrdoba* **23:** 549, 1919 (Fig. 15).

Pseudothecia up to 300 µm broad. Asci 60-65 × 25-30 µm. Ascospores 3-6 septate, ellipsoidal to fusoid, 30-54 × 10-15 µm.

Antennatula conidia with a distinct subglobose to barrel shaped basal swelling, not constricted at the septa, 10-12 septate, 124-150 × 13.5-16.2 µm.

Hormisciomyces phialides 4.5-5.5 µm broad. Phialoconidia about 1 µm in diam., aggregated in a slimy head.

On *Miconia* spp. Costa Rica.

TRICHOPELTHECA Bat., Costa & Cif., *Ist. Bot. Univ. Lab. Crittog. Pavia Atti* ser. 5, **15:** 44, 1957.

Type sp.: *T. asiatica* Bat., Costa & Cif., *ibid* **15:** 45, 1957.

Anamorphs: *Plokamidomyces* Bat., Costa & Cif. and *Trichothallus* F. Stev.

Only two species known and they often occur mixed with other sooty moulds on the upper surface of leaves, petioles and branches. Hughes (1965) has described and illustrated them in detail.

Thallus superficial closely adpressed to the substratum, pale brown to dark brown black when dry, setose, one cell thick, more or less

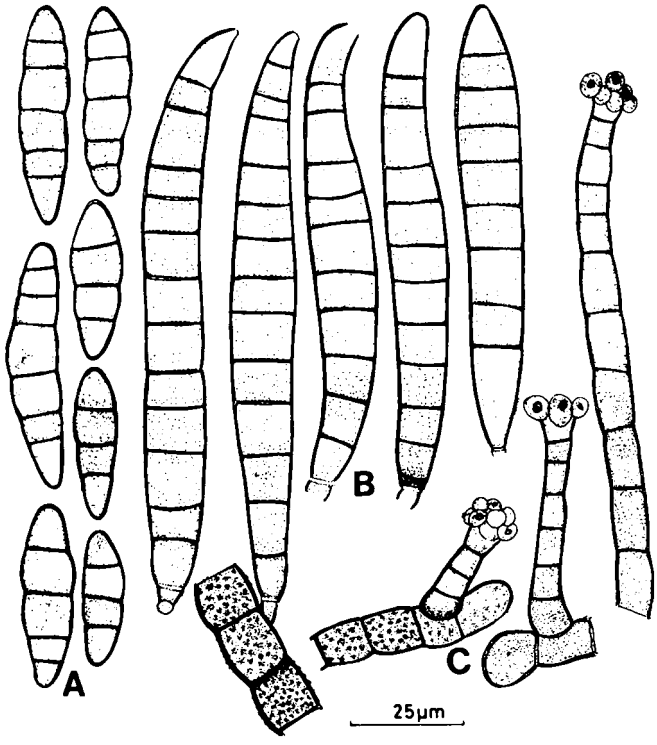


Fig. 15. *Euantennaria tropicicola* (type). A, ascospores; B, *Antennatula* conidia; C, *Hormisciomyces* state.

rounded, with or without broad lobes or composed of radiating narrow, strap-shaped branches which are irregularly or more or less dichotomously divided. The cells of the thallus are more or less rectangular, finally roughened at the exposed side. Setae erect, simple straight or curved, septate, brown to dark brown, paler towards the apex, arising from a single thallus cell which is thicker-walled and darker than the others, two-layered. Pseudothecia develop on the thallus, scattered, subglobose, dark brown to black, ostiolate, setose, with a pseudoparenchymatous wall bearing *Plokamidomyces* phialophores. Asci obovoid, subsessile, 4-8 spored. Ascospores pale brown to olivaceous brown, 3-7 septate, occasionally with one or two vertical septa in one or two cells, slightly constricted at the septa, smooth, narrowly ellipsoidal and mucronate at both ends or broadly obovoid and mucronate at the base and rounded at the apex.

Plokamidomyces: Phialides in whorls of 4-9 on simple setose, erect hyphae. Conidia broadly ellipsoidal, hyaline, minute and formed in a slimy head within the whorl of phialides.

Trichothallus: Phragmoconidia develop singly from scattered cells of the thallus and arise as blown out projections (blastic) on the upper surface. Phragmoconidia hyaline and clavate when young, fusiform when mature, septate, smooth, pale brown to dark brown, usually curved, rarely straight, occasionally sigmoid, tapering towards the flat basal scar, subulate to attenuate at the apex which is generally bent and paler, becoming detached readily from the thallus.

Key to Trichopeltheca species

Ascospores 3-7 septate, 18-35 × 6-12 μm..... *T. asiatica*

Ascospores 3 septate, 18.5-25 × 9-11.5 μm..... *T. stevensii*

T. asiatica Bat., Costa & Cif., *Ist. Bot. Univ. Lab. Crittog. Pavia Atti ser.* 5, **15:** 45, 1957 (reprint p. 13). (Fig. 16)

Phycopeltis nigra Jennings, *Proc. R. Ir. Acad. Sci.* **3:** 758, 1896.

Anamorph: *Plokamidomyces colensoi* Bat., Costa & Cif., *Ist. Bot. Univ. Lab. Crittog. Pavia,* ser. 5, **15:** 47, 1957 (reprint p. 15).

Thallus more or less rounded, broadly lobed. Setae smooth, abundant up to 23 septate, 50-200 × 5.5-7 μm wide at the base, smooth, expanding to 6-11 μm wide, finally tapering to a rounded apex 3.2-3.6 μm wide. Pseudothecia up to 160 μm broad, setose. Asci 45-55 × 17-20 μm, 4-8 spored. Ascospores 3-7 septate, with vertical septum in 1-3 cells, 18-35 × 6-12 μm.

Trichothallus conidia rarely formed, scattered or in groups, 7-15 septate, 40-110 × 8-13.5 μm.

Plokamidomyces phialides 4-9 in a whorl, 4.2-5.6 × 3.5-4.5 μm. Phialoconidia 2 × 1.3 μm.

On *Olearia colorata* (type) and on over 80 different hosts. A common fungus in New Zealand (Hughes, 1965).

T. stevensii S. Hughes, *N.Z. Jl Bot.* **3:** 329, 1965 (Fig. 17).

Anamorph: *Trichothallus hawaiiensis* F. Stev., *Bull. Bernice P. Bishop Mus.* **19:** 85, 1925.

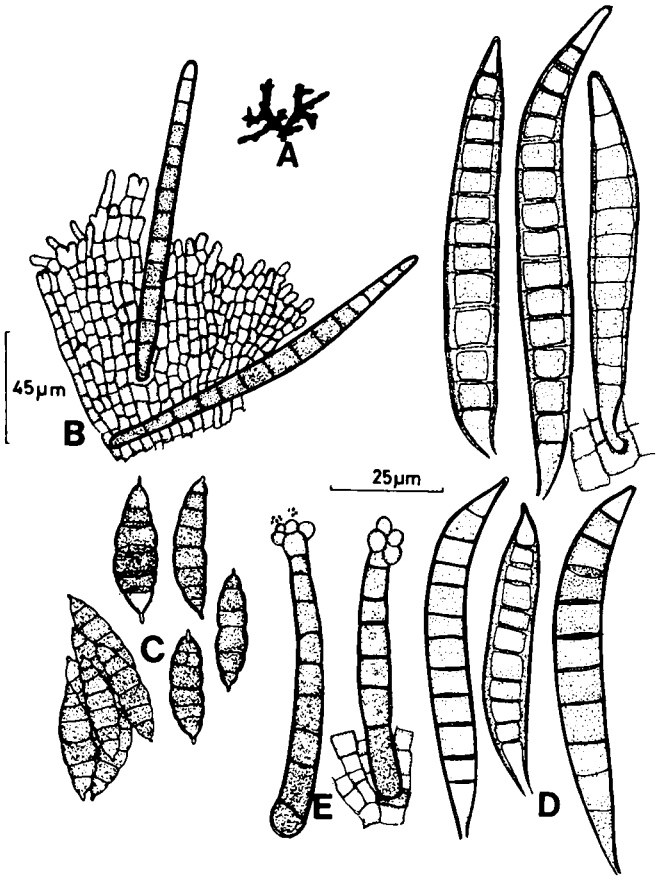


Fig. 16. *Trichopeltheca asiatica*. A, thallus; B, part of thallus with setae; C, ascospores; D, *Trichothallus* conidia; E, *Plokamidomyces* state.

Thallus composed of irregularly radiating strap-shaped branches. Setae 3-16 septate, slightly rough-walled, scanty or abundant, 55-135 × 4-5.5 μm at the base, then expanding to 7.2-11 μm wide, finally tapering gradually to a rounded apex 4.5-5.5 μm wide. Pseudothecia up to 110 μm broad, setose, Asci 48-55 × 19.5-25 μm, 8 spored. Ascospores 3 septate, with a vertical septum in 1 or 2 cells, 18.5-25 × 9-11.5 μm.

Trichothallus conidia scattered, occasionally formed in groups, 9-16 septate, 66-126 × 10-14.5 μm.

Plokamidomyces phialides 4-6 μm, formed in a whorl 4-5 μm wide. Phialoconidia 1.5-2 × 0.8-1 μm.

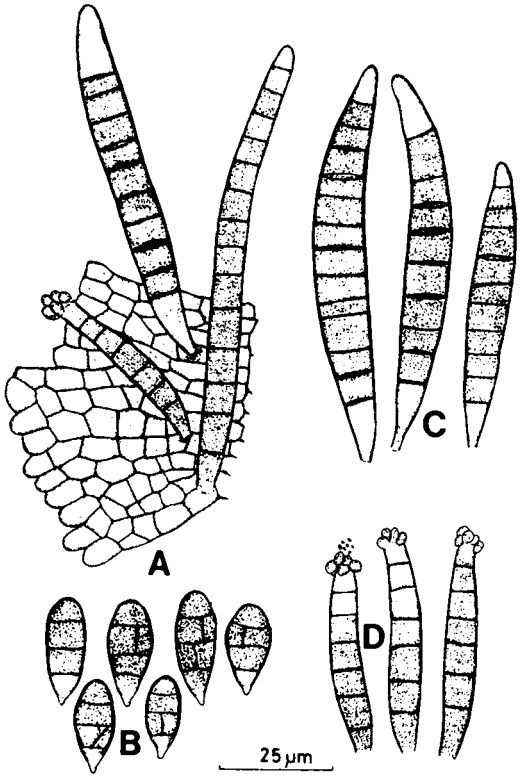


Fig. 17. *Trichopeltheca stevensii* (type). A, portion of thallus with seta, *Trichothallus* conidium and *Plokamidomyces* phialide; B, ascospores; C, *Trichothallus* conidia; D, *Plokamidomyces* phialides and conidia.

On *Cibotium chamissoi* (type), Hawaii. Also on *Vitex,* Puerto Rico and *Cheirodendron trigynum* var. *multiflorum,* Hawaii.

Parodiopsidaceae Toro

Pseudothecia more or less globose, superficial on dark brown hyphae, opening by gelatinization of a small apical pore region at maturity. Ascospores hyaline to brown, one or more celled.

Key to genera of Parodiopsidaceae

Ascospores one celled..... *Pilgeriella*

Ascospores septate..... 1

1. Ascospores 5-7 septate..... *Ophioparodia*

   Ascospores 1-5 septate..... 2

2. Superficial mycelium absent but a basal stroma present, ascospores 1-3(4) septate..... *Chevalieropsis*

   Superficial mycelium present, hyphopodiate or non hyphopodiate..... 3

3. Superficial mycelium hyphopodiate, ascospores one septate.. *Balladynopsis*

   Superficial mycelium non hyphopodiate..... 4

4. Ascospores with end cells capped by a black plug, 3(4) septate..... *Meliolina*

   Ascospores with end cells not capped..... 5

5. Hyphae with prominent sculpturing in the form of a network (also in *Acrogenotheca ornata),* ascospores 1-3 septate..... *Brooksia*

   Hyphae without sculpturing in the form of a network..... 6

6. Ascospores one septate..... *Alina*

   Ascospores 1-5 septate..... 7

7. Ascospores 1-5 septate, anamorph *Septoidium*..... *Perisporiopsis*
   Ascospores 3-5 septate, anamorph pycnidial..... *Acrogenotheca*

Key to genera with Septoidium anamorph

Ascospores one celled..... *Pilgeriella*

Ascospores septate..... 1

1. Ascospores 5-7 septate..... *Ophioparodia*

   Ascospores 1-5 septate..... *Perisporiopsis*

Key to genera with Tretospora anamorph

Superficial mycelium hyphopodiate..... *Balladynopsis*

Superficial mycelium non hyphopodiate..... *Alina*

Key to genera with Y-shaped to apically lobed anamorph

Basal stroma present, superficial mycelium absent..... *Chevalieropsis*

Basal stroma absent, superficial mycelium present *Perisporiopsis brachystegiae*

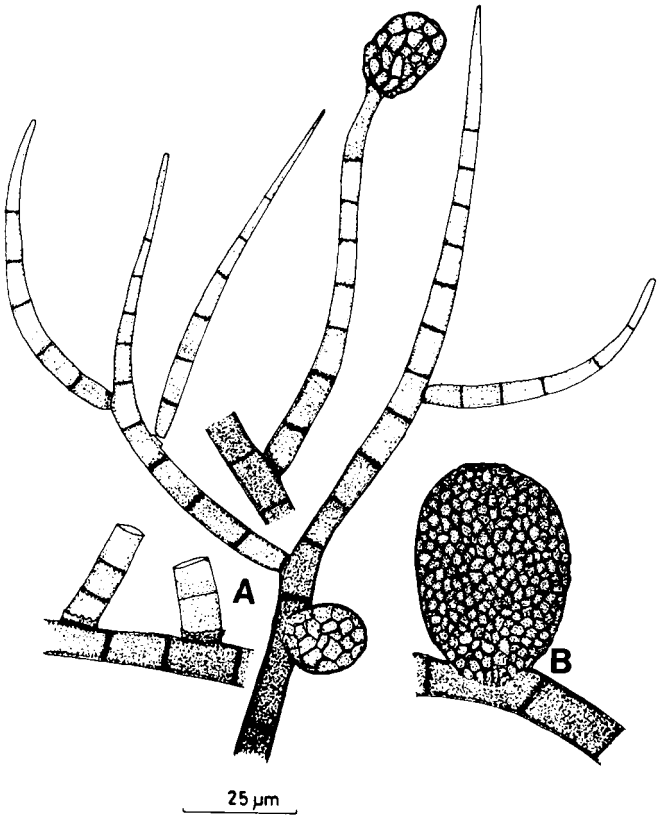


Fig. 18. *Acrogenotheca elegans.* A, erect hyphae bearing pseudothecium and pycnidium; B, pseudothecium.

ACROGENOTHECA Cif. & Bat. apud Bat. & Cif., *Saccardoa* **2:** 51, 1963.

Type sp.: *A. elegans* (Fraser) Cif. & Bat.

A. elegans (Fraser) Cif. & Bat. in Bat. & Cif., *Saccardoa* **2:** 52, 1963 (Figs. 18 & 19)

Capnodium elegans Fraser, *Proc. Linn. Soc. N.S.W.* **60:** 169, 1935.
Acrogenotheca pulcherrima Bat. & Cif., *Saccardoa* **2:** 53, 1963.
Oedemium robustum Berk. in J.D. Hook., *Bot. Antarctic Voy. of H.M. Ships Erebus and Terror 1839-1843, II Flora Novae-Zelandiae Part II. London:* 198, 1855.
Antennaria heteracantha Speg., *Boln Acad. nac. Cienc. Côrdoba* **11:** 621, 1889.

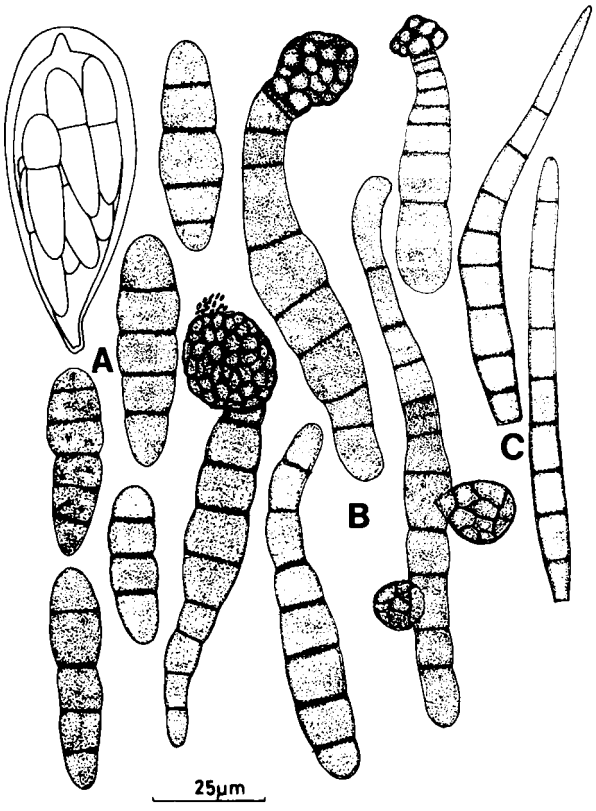


Fig. 19. *Acrogenotheca elegans*. A, ascus and ascospores; B, pycnidia on germinating ascospores and lateral branches; C, seceded lateral branches.

Colonies black, dense, felty or velutinous on leaves, twigs and trunks, often mixed with other sooty moulds. Mycelium superficial composed of repent and erect hyphae. Repent hyphae straight, brown to dark brown, sometimes anastomosing, generally branching at right angles, reticulate, septate, with constriction at the septa where the erect branches arise. Erect and lateral hyphae variable in size, arising singly from a darker swollen group of cells of the repent hyphae and consist of a main stalk bearing alternate or unilateral branches near apex and tapered to a point, smooth, dark brown and septate but paler towards the apex. Lateral branches are formed from the inner wall layer and burst through the outer wall leaving an irregular dark frill at the base and they

are capable of germinating into a new hypha or rarely a pycnidium after liberation from the main branch.

Pseudothecia black, globose to pyriform, rarely ellipsoid, occasionally flattened, ostiolate, up to 175 μm broad, 350 μm high, borne singly or in pairs laterally or sometimes terminally on the main branch, or on lateral branches of erect hyphae. Asci fasciculate, clavate to broadly clavate or almost ovoid, thick-walled near the apex, 4-8 spored, 95-145 × 35-60 μm. Ascospores very variable in size and septation, 3-5 septate, olivaceous to dark brown when mature, constricted at the median septum, straight or slightly curved, broadly ellipsoidal or subcylindrical or fusiform, 29-85 × 9-20 μm.

Pycnidia formed on the main stalk, on lateral branches of smaller erect hyphae, on germinating ascospores and fallen lateral branches, black or brown, subglobose, thin-walled, up to 55 μm high and 45 μm broad. Pycnidiospores (spermatia) hyaline, ellipsoid to rod-shaped, one celled, 2.5-3 × 0.5-1 μm.

On a wide variety of hosts. Argentina, Australia, Columbia, Cuba, Indonesia, New Caledonia, New Guinea, New Zealand and Sri Lanka.

Hughes (1967b) has given a detailed account of this species. Deighton & Pirozynski (1966) described *Acrogenotheca ornata* which is similar to *A. elegans* but lacks the pycnidial state. It also shows prominent sculpturing in the form of a network on the hyphae as in *Brooksia tropicalis*. In both *A. elegans* and *A. ornata* lateral branches or conidium-like branches of the erect hyphae can secede and function as conidia.

ALINA Racib., *Bull. L'Acad. Sci. Cracovie* **3**: 374, 1909.

The genus is monotypic and differs from the closely related *Balladynopsis* Theiss. & H. Sydow by non hyphopodiate mycelia and intramatrical hypostroma. Both *Balladynopsis* and *Alina* have a *Tetrospora* anamorph (Sivanesan, 1981).

A. jasmini Racib., *Bull. L'Acad. Sci. Cracovie* **3**: 374, 1909 (Fig. 20).

Colonies amphigenous, scattered, black, rounded, 1-2 mm in diam., often becoming confluent. Mycelium in the centre of the colony is very dense forming a mat from which superficial, brown hyphae radiate over the leaf surface and hyaline hyphae penetrate the epidermis and the mesophyll tissue where they form an intramatrical hypostroma. Superficial mycelium is non hyphopodiate, smooth, brown, septate, sparingly

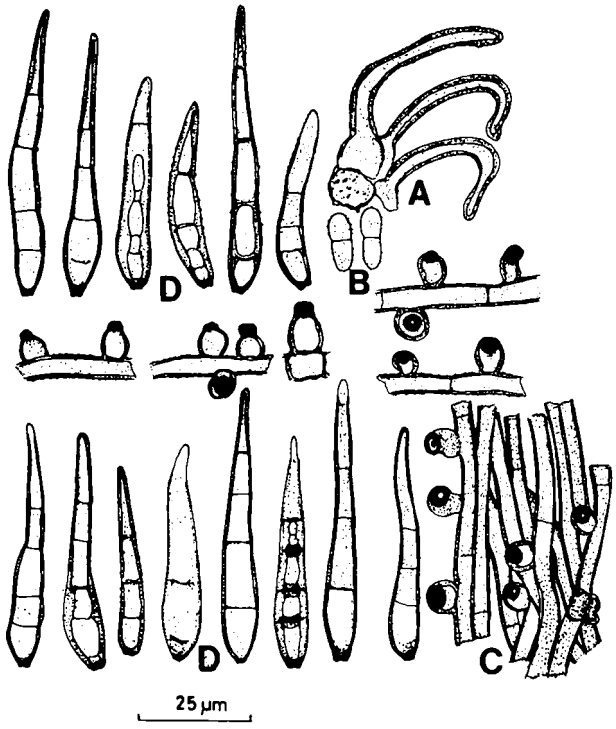


Fig. 20. *Alina jasmini* (type). A, portion of pseudothecial wall with setae; B, ascospores; C, hyphae with conidiophores; D, conidia.

branched, more or less coalescing with one another, 4-6 µm thick. Pseudothecia scattered in the centre of the colony, superficial, stalked, dark brown, globose to subglobose, setose, 40-50 µm broad, with or without an indistinct apical pore. Setae few, brown, simple, smooth, curved, continuous, 40-80 × 4-8 µm. The wall is one layered and is composed of moderately thick-walled, brown, semi-transparent, pseudoparenchymatic cells, 4-6 µm wide with granular surface. Asci ovoid or broadly ellipsoid, 8 spored, 21-39 × 10-17 µm. Ascospores conglobate, brown, smooth to slightly roughened, oblong, one septate just above the middle, somewhat constricted at the septum, 12-15 × 4-5 µm, with obtuse or acute rounded ends. Pseudoparaphyses mucose at an early stage.

Conidiophores single, arising terminally and laterally on the hyphae, curving acutely to assume an erect position, simple, brown, continuous, 9-11 × 7-9 µm, for most part thin-walled but thick-walled at

the truncate dark apex. Conidia arising singly apparently through a thin pore at the darkly thickened truncate apex of each conidiophore, smooth to sometimes lightly verruculose, obclavate, rostrate, brown, 3-5 distoseptate, 36-70 × 7-10 μm, mostly 3-4 distoseptate and 55-65 × 7-9.5 μm, up to 4.5 μm thick at the truncate base and attenuating to a 2 μm thick paler apex.

On leaves of *Jasminum* spp. Indonesia.

Müller & von Arx (1962) incorrectly placed the anamorph in *Septoidium* or *Sporidesmium* and erroneously suggested that it is similar to *S. jasminicola* M.B.Ellis.

BALLADYNOPSIS Theiss. & H. Sydow, *Annls mycol.* **15:** 475, 1918 (1917).

Balladynastrum Hansf., *Proc. Linn. Soc. Lond.* **153:** 15, 1941.
Wageria F. Stev. & Dalbey, *Mycologia* **11:** 7, 1918.
Xenostigmella Petrak, *Sydowia* **4:** 369, 1950.

Type sp.: *B. philippinensis* (H. & P. Sydow) Theiss. & H. Sydow, *Annls mycol.* **15:** 476, 1918(1917).

Anamorph: *Tretospora* M. B. Ellis (1976).

Mycelium superficial, smooth to verruculose, hyphopodiate, non setose, often reticulately branched and anastomosing, brown, septate, may or may not bear conidiophores. Pseudothecia superficial on mycelia, globose to subglobose, setose, stalked, dark brown, initially cleistothecioid, later with an apical pore formed by gelatinization and crumbling of the apical wall cells and supported above the level of the vegetative mycelium by hyphal struts arising from the lower part of the pseudothecial wall. Hyphal struts usually non hyphopodiate and paler than the setae which are usually borne on the upper half of the pseudothecium. Peridium thin, usually of one layer, pseudoparenchymatic, mostly verrucose when young, semi-transparent with a distinct outer granular surface. Asci few, sessile to subsessile, thick-walled near the apex, broadly ellipsoid to ovoid, 4-8 mostly 8 spored, ripening in succession with few asci containing mature ascospores. Ascospores initially hyaline, later olivaceous brown to brown or dark brown, smooth to verruculose after discharge, ellipsoid, oblong, or ovoid, slightly submedianly septate or septate in the middle, constricted at the septum, thick-walled, germinating to hyphopodia. Pseudoparaphyses mucose.

Conidiophores macronematous or semi-macronematous, mononematous, numerous, arising laterally and terminally on the hyphae,

mixed with hyphopodia, short, curving acutely to assume an erect position, 0-1 septate, olivaceous brown to brown, smooth. Conidiogenous cells monotretic, integrated and terminal, sometimes comprising the whole conidiophore. Conidia arising terminally through a darkly thickened pore at the apex of the conidiophore, dry, straight or curved, obclavate, rostrate, mid to dark brown, smooth to verruculose, distoseptate.

About twelve species known and they are all foliicolous, mostly on plants of Rubiaceae (Sivanesan, 1981). The genus is distinguished from the closely related genera, *Balladyna* Racib. by non setose mycelia and *Tetrospora* anamorph, from *Alina* Racib. by hyphopodiate mycelia and from *Balladynocallia* Bat. by setose pseudothecia.

Key to Balladynopsis with Tretospora anamorph

Conidia verruculose..... 1

Conidia smooth..... 2

1. Conidia less than 100 μm long gradually tapering to a narrow apex..... *B. johnstonii*

   Conidia 65-128 μm long abruptly tapering to a long filamentous apex..... *B. negrii*

2. Conidia less than 100 μm long..... *B. ebbelsii*

   Conidia 55-175 μm long..... 3

3. Conidia broadly obclavate below and narrowly tapering to a long filamentous apex not more than 4 μm wide..... *B. vanderystii*

   Conidia narrowly obclavate below and gradually tapering to an apex 4 mm or more wide..... *B. urtiagae*

B. ebbelsii Sivan., *Mycol. Pap.* **146:** 10, 1981 (Figs. 21 & 22)

Anamorph: *Tretospora* sp.

Colonies amphigenous, mostly epiphyllous, at first rounded and discrete, later widely effused, up to 6 mm in diam., sometimes confluent, dark brown. Hyphopodia numerous, unilateral or alternate, sometimes opposite, mostly subglobose, rarely clavate, simple or minutely lobed at the margin, dark brown and darker than the hyphae, 6-9.5 × 5-7 μm. Pseudothecia 50-90 μm broad, with 3-8 setae on the upper half. Setae 0-4 septate, up to 90 μm long, 4-5 μm thick at the base, with an acute or obtuse paler apex which sometimes bulges into a small hyaline vesicle.

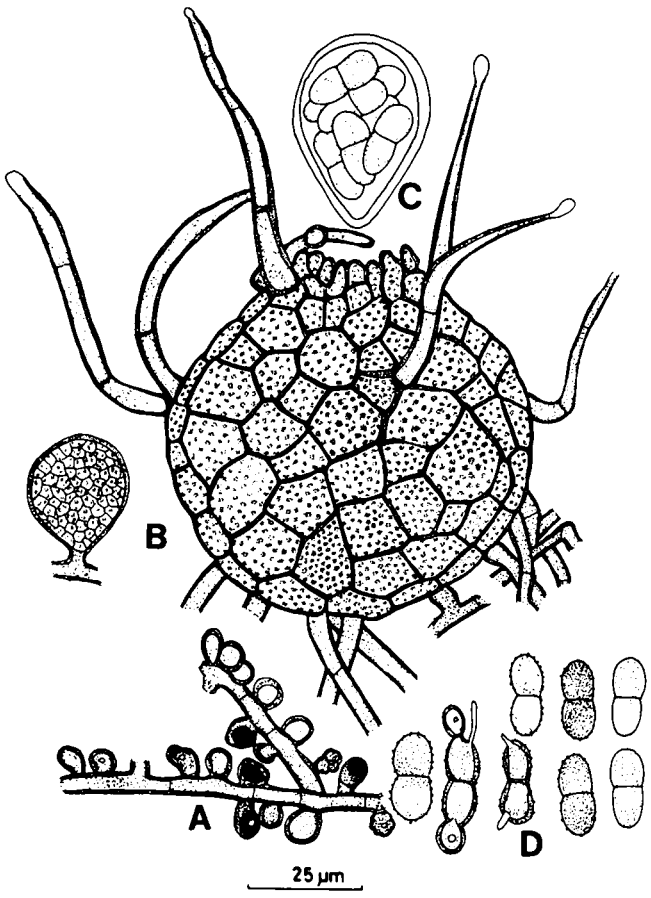


Fig. 21. *Balladynopsis ebbelsii* (type). A, hyphae with hyphopodia and conidiophores; B, pseudothecia (young and mature); C, ascus; D, ascospores.

Asci 35-45 × 22-29 µm. Ascospores smooth, after liberation dark brown and verruculose, 18-23 × 7-9.5 µm, with rounded ends.

Conidiophores continuous or rarely one septate, up to 14 µm long, 4.5-6 µm thick, for most part thin-walled but thickened and darkened at the truncate apex. Conidia smooth, 3-6 (mostly 4-5) distoseptate, 49-81 × 9.5-12.5 µm, attenuated to 2.2-7 µm thick apex and 5.5-7 µm wide at the thick-walled truncate base.

On indet. leaves, Tanzania.

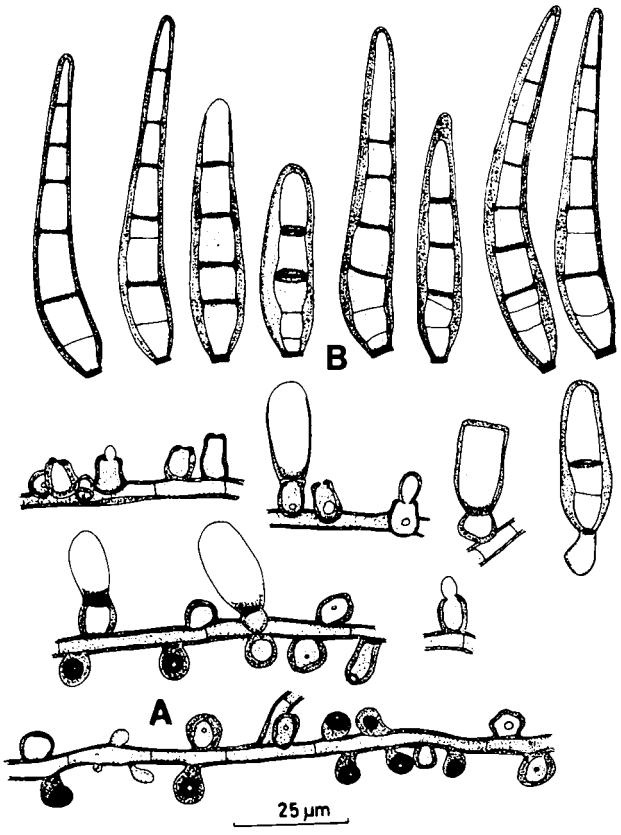


Fig. 22. *Balladynopsis ebbelsii* (type). A, hyphae with conidiophores; B, conidia.

B. johnstonii Sivan., *Mycol. Pap.* **146:** 15, 1981 (Fig. 23).

Colonies mostly hypophyllous, sometimes epiphyllous. Hyphopodia 7-12 × 5-7 µm. Pseudothecia 50-80 µm broad, bearing 3-11 setae. Setae 0-3 septate, 30-48 × 4 µm, with an obtuse or acute paler apex. Asci 32-45 × 23-30 µm. Ascospores, brown, smooth-walled inside the ascus, becoming verruculose after discharge, slightly unequally septate or rarely septate in the middle, 20-23 × 9-11.5 µm, with rounded ends.

Conidiophores 9-13 × 4-7 µm. Conidia smooth but becoming distinctly verruculose later, (2)4-6 distoseptate, 50-98 × 8-11 µm, attenuating to a 2-3 µm thick paler apex and up to 4 µm wide at the thick-walled truncate base.

On leaves of *Gardenia tahitensis,* New Hebrides.

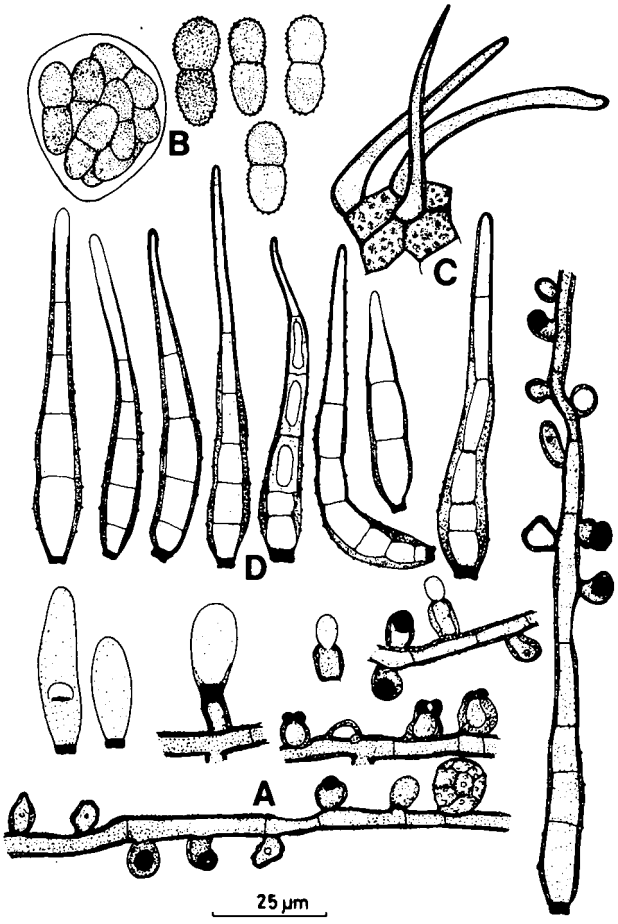


Fig. 23. *Balladynopsis johnstonii* (type). A, hyphae with hyphopodia and conidiophores; B, ascus and ascospores; C, portion of pseudothecial wall with setae; D, conidia.

B. negrii (E. Castell.) M. B. Ellis, *Mycol. Pap.* **82:** 50, 1961 (Fig. 24).

Phaeodimeriella negrii E. Castell., *Nuovo G. bot. Ital.* **53:** 215, 1947.
Balladynagra negrii (E. Castell.) Bat. & Peres, *Atas. Inst. Micol.* **5:** 464, 1967 (not validly published, Art 43).

Anamorph: *Tretospora negrii* M. B. Ellis, *More Dematiaceous Hyphomycetes:* 373, 1976.

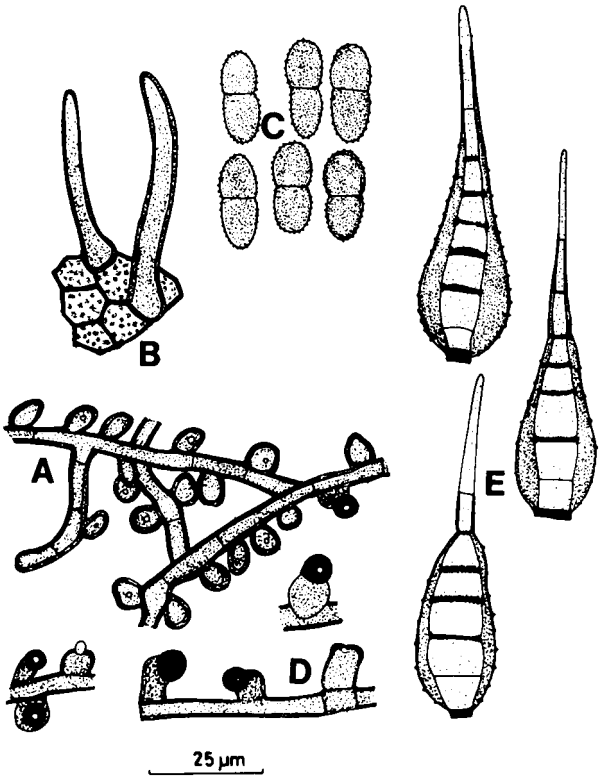


Fig. 24. *Balladynopsis negrii* (type). A, hyphae with hyphopodia; B, portion of pseudothecial wall with setae; C, ascospores; D, hyphae with conidiophores; E, conidia.

Colonies epiphyllous. Hyphopodia 6-10 × 5-8 µm. Pseudothecia 40-85 µm broad bearing 3-6 setae. Setae 0-few septate, up to 50 µm long and 6-8 µm wide at the base. Asci 25-40 × 20-28 µm. Ascospores pale brown, smooth-walled inside the ascus, becoming brown and verruculose after discharge, slightly unequally septate with a smaller upper cell or septate in the middle, 20-24 × 8-10 µm.

Conidiophores 10-22 × 6-8 µm. Conidia often verruculose, 5-8 distoseptate, 65-128 × 13-15 µm, 5-6 µm wide at the base, 2-3 µm thick at the apex, very dark at the hilum.

On leaves of *Gardenia, Meyna* and *Randia*. Burma, Ethiopia and India.

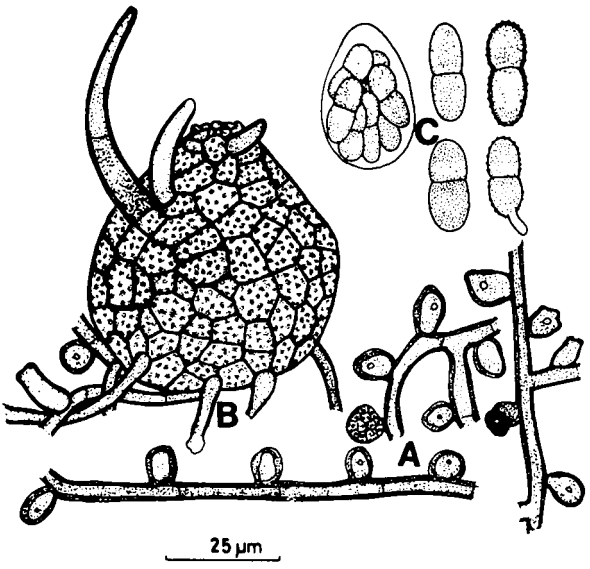


Fig. 25. *Balladynopsis urtiagae* (type). A, hyphae with hyphopodia; B, pseudothecium; C, ascus and ascospores.

B. urtiagae Sivan., *Mycol. Pap.* **146:** 27, 1981 (Figs. 25 & 26).

Anamorph: *Tretospora* sp.

Colonies epiphyllous. Hyphopodia 9-10 × 6-8 µm. Pseudothecia 42-70 µm broad, with setae. Setae up to eight in number, 14-60 × 2.5-4.5 µm, with an acute to obtuse paler apex. Asci 35-42 × 20-23 µm. Ascospores slightly unequally septate or septate in the middle, smooth-walled inside the ascus, after discharge becoming distinctly verruculose, 16-22 × 7-10 µm.

Conidiophores 9-16 × 5.5-9 µm. Conidia smooth, 4-10 distoseptate, 55-135 × 8.5-11.5 µm wide at the broadest region, attenuated to a 4-7 µm thick paler apex, 3.5-6.5 µm wide at the truncate base.

On leaves of *Genipa americana,* Venezuela.

B. vanderystii Hansf., *Sydowia Beih.* **1:** 87, 1957 (Fig. 27).

Balladynopsis crossopterygis Deighton & M. B. Ellis in M. B. Ellis, *Mycol. Pap.* **70:** 11, 1958.

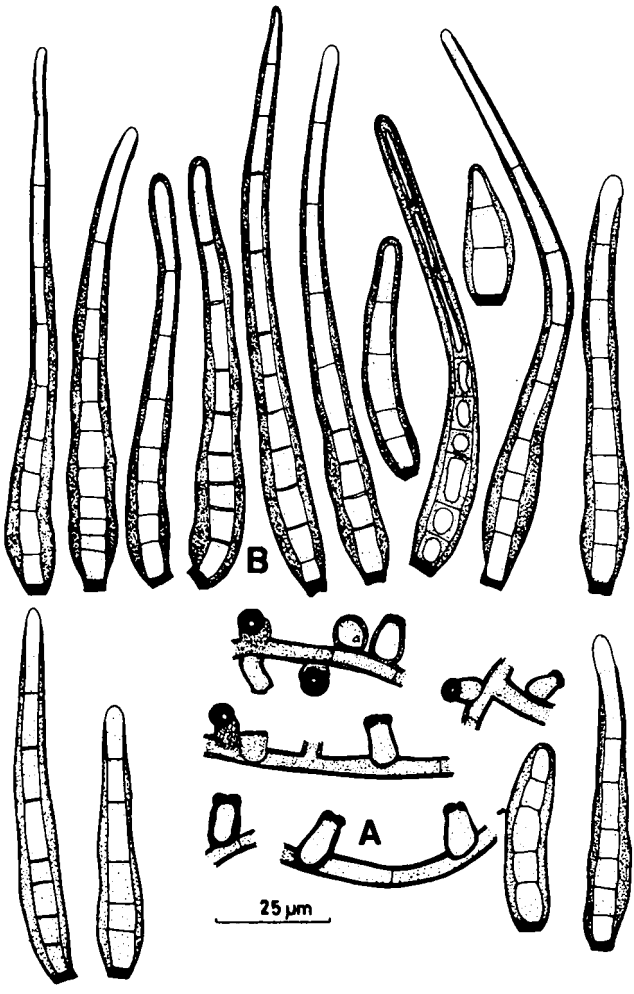


Fig. 26. *Balladynopsis urtiagae* (type). A, hyphae with conidiophores; B, conidia.

Balladyna vanderystii (Hansf.) von Arx in E. Müller and von Arx, *Beitr. Kryptogamenfl.* Schweiz **11:** 186, 1962.
Balladyna vanderystii (Hansf.) von Arx var. *ferulae-foetidae* Mya Thaung, *Trans. Br. mycol. Soc.* **67:** 435, 1976.

Anamorph: *Tretospora* sp.

Colonies amphigenous, mostly hypophyllous. Hyphopodia 7-10 × 5-7 µm. Pseudothecia 45-100 µm broad, with 3-10 setae. Setae 40-105 ×

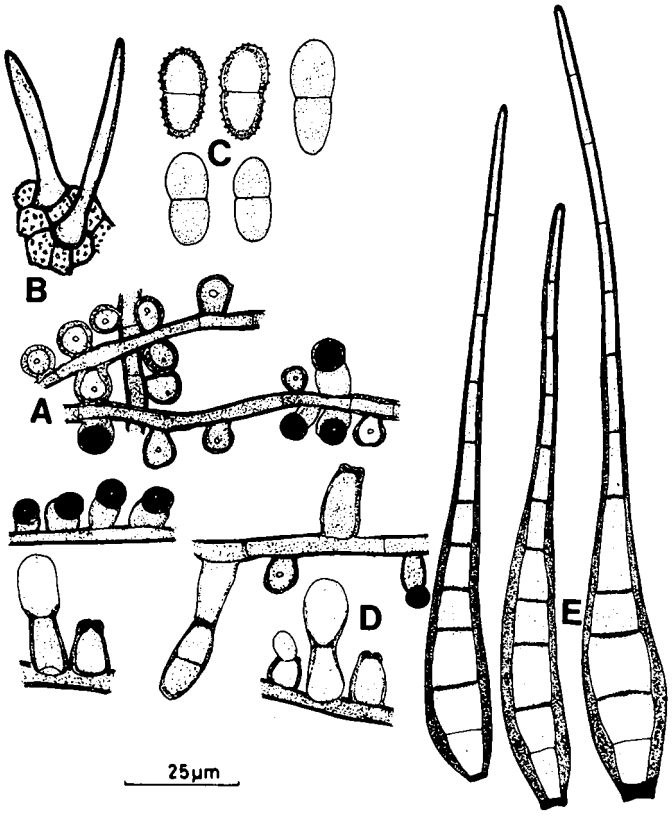


Fig. 27. *Balladynopsis vanderystii* (type). A, hyphae with hyphopodia and conidiophores; B, portion of pseudothecial wall with setae; C, ascospores; D, hyphae with conidiophores; E, conidia.

5-6 µm. Asci 25-60 × 19-30 µm. Ascospores oblong, somewhat slightly unequally septate with a broader but smaller upper cell, smooth inside the ascus, after discharge becoming verruculose, 17.5-25 × 7.5-11 µm.

Conidiophores 8-16 × 5-9 µm. Conidia 5-11 distoseptate, 70-175 × 10-18 µm, 6-8 µm wide at the truncate base, 3-4 µm thick at the attenuated apex.

On leaves of *Crossopteryx febrifuga, Ferula foetida* and *Gardenia lucida*. Burma, India and Sierra Leone.

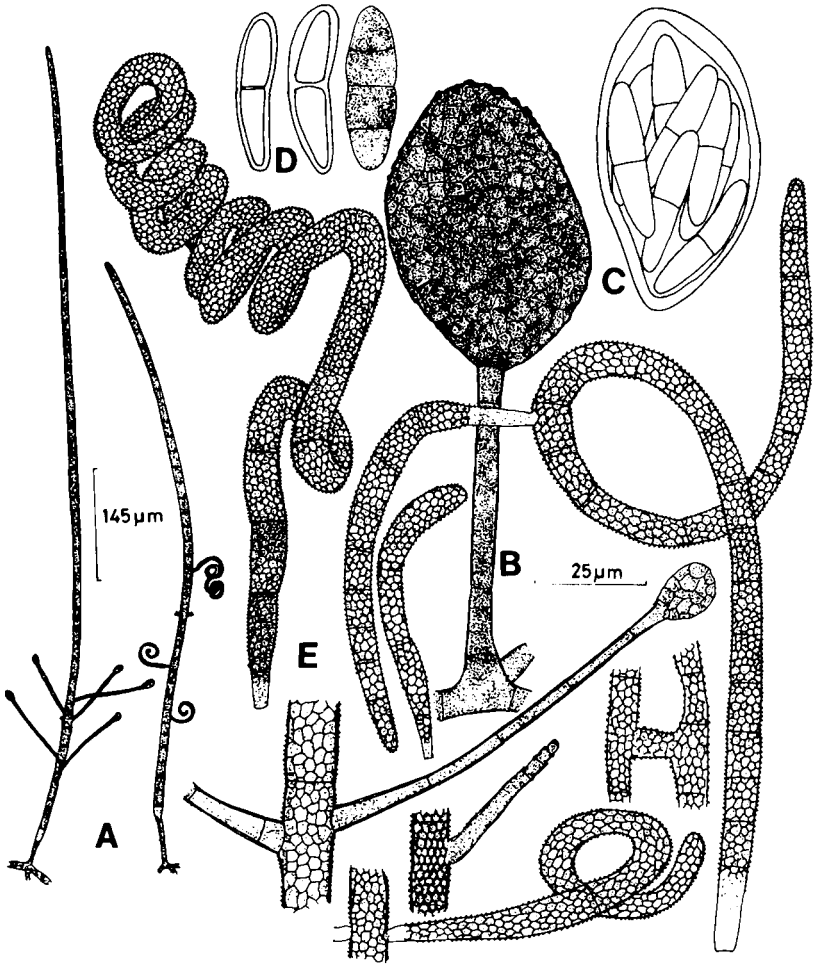


Fig. 28. *Brooksia tropicalis.* A, habit; B, pseudothecium; C, ascus; D, ascospores; E, conidiophores and conidia.

BROOKSIA Hansf., *Proc. Linn. Soc. N.S.W.* **81:** 32, 1956.

Capnogonium Bat. & Peres, *Publ̃oes Inst. Micol. Recife* **314:** 6, 1961.

The genus is monotypic.

B. tropicalis Hansf., *Proc. Linn. Soc. N.S.W.* **81:** 32, 1956 (Fig. 28).

Capnogonium polymorphum Bat. & Peres, *Publ̃oes Inst. Micol. Recife* **314:** 6, 1961.

Anamorph: *Hiospira hendrickxii* (Hansf.) R. T. Moore, *Trans. Br.*

mycol. Soc. **45**: 145, 1962.

Helicosporium hendrickxii Hansf., *Publs Inst. natn. Étude agron. Congo belge* **2**: 52, 1956.

Hiospira jambosae Bat., Bezerra & Peres, *Anais Congr. Soc. bot. Brazil* **13** (1962): 364, 1964.

Pseudothecia single, superficial on erect, dark brown, smooth, septate stalks, unilocular, pyriform to obovoid, 50-120 × 45-80 μm. Stalks up to 100 μm long and up to 9 μm thick. Pseudoparenchymatous wall one cell layer thick, composed of rounded to angular cells tearing irregularly at the apex. Abortive ascomata sometimes develop laterally near the base of the erect stalks, singly or in opposite pairs or sometimes in whorls of three. Asci 3-5, ovoid, sessile, 8 spored, 60-75 × 40-50 μm. Ascospores hyaline to pale olive brown, narrowly elliptical to subclavate, sometimes curved, 1-3 septate, constricted at the primary septum, 30-42 × 11-15 μm.

Colonies brown, effuse, usually hypophyllous. Hyphae repent forming a superficial mycelial network from which arise stalked ascomata and erect filaments which may be sterile or bear conidia, pale to dark brown, septate, smooth. Erect filaments straight or occasionally branched, constricted near the base and then abruptly expanding into a sculptured hypha, narrowing towards the rounded apex, olive to chestnut brown, closely septate, with wall coarsely and distinctly reticulate. Sometimes two filaments become spirally twisted around each other and connected at intervals by a short hypha. Sometimes chlamydospore-like bodies are found at tips of filaments and these may germinate to produce 2-4 radiating filaments which are capable of germination.

Conidia brown terminating as blastospores from short pegs which occur singly and alternately or on opposite pairs, and arise laterally from erect filaments. Pegs pale yellow brown, narrowly vasiform, non-septate, cylindrical, simple, 10-16 μm long, with a flat unthickened terminal scar. Conidia much coiled, up to 90 × 40 μm.

On leaves of many plants, common in moist tropics and often associated with other fungi.

Deighton & Pirozynski (1966) have given a good account of this species with beautiful illustrations.

CHEVALIEROPSIS Arnaud, *Annls Epiphyt.* **9**: 2, 1923.

Chevalieria Arnaud, *C.R.Acad. Paris* **170**: 203, 1920.

Anamorphs: Macroconidial state *Septoidium*-like with Y-shaped stau-

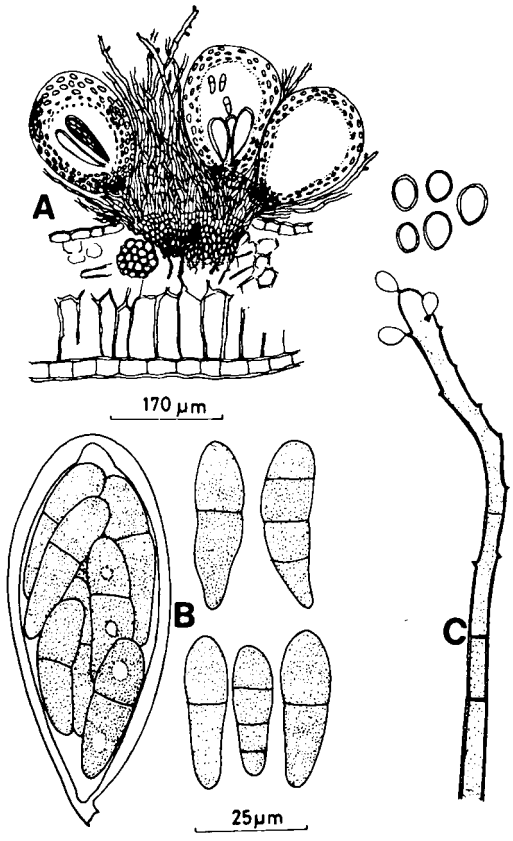


Fig. 29. *Chevalieropsis ctenotricha.* A, v.s. pseudothecia; B, ascus and ascospores; C, conidiophore and microconidia.

roconidia and microconidial state with smaller one celled conidia on denticulate conidiophores similar to those found in *Perisporiopsis.*

The genus is monotypic.

C. ctenotricha (Pat. & Har.) Arnaud, *Annls Epiphyt.* **9**: 2, 1923. (Figs. 29 & 30).

Dimerosporium ctenotrichum Pat. & Har., *J. de Bot.* **14:** 242, 1900.
Chevalieria ctenotricha (Pat. & Har.) Arnaud, *C.R.Acad. Paris* **170:** 203, 1920.

Colonies amphigenous, mostly hypophyllous, forming several erumpent spots with discolouring zone around each pustule, sometimes coalescing to form large distorted areas. Basal stroma immersed in the leaf tissues

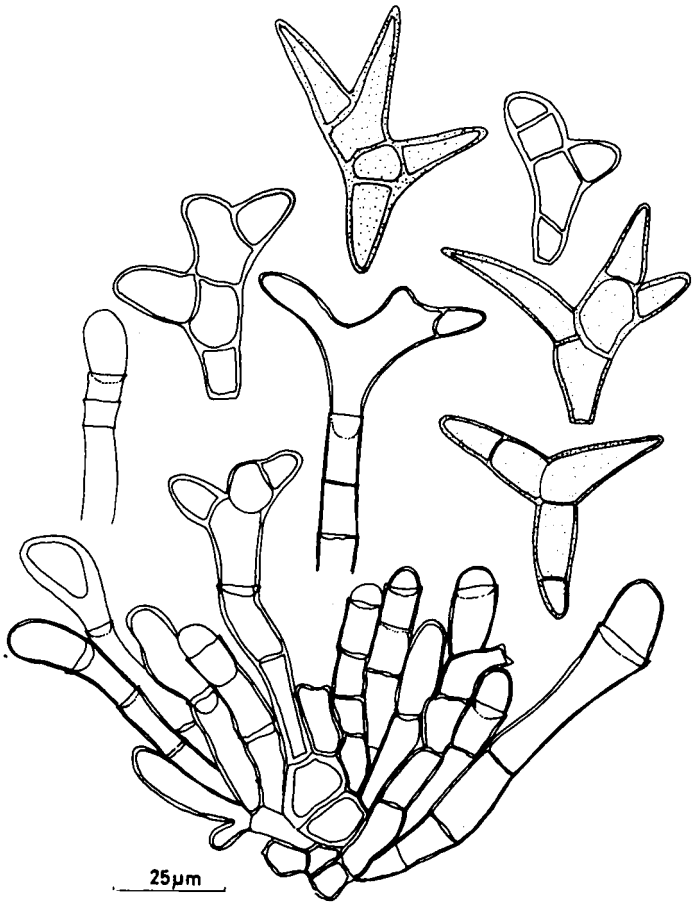


Fig. 30. *Chevalieropsis ctenotricha.* Conidiophores and macroconidia.

and erumpent through the epidermis and cuticle, composed of thick-walled brown cells arranged more or less in vertical rows. Internal mycelium composed of hyphae which grow in the intercellular spaces of the palisade tissues. Pseudothecia aggregated in groups among the conidiophores on the epistroma, globose to subglobose, 150-200 × 150-180 µm. The pseudothecial wall is red brown and composed of transparent angular cells on the outside and almost polygonal cells towards the inside. In mature pseudothecia the outer wall cells usually separate from one another and break at the apex which becomes mucilaginous. Asci subglobose to clavate, sessile, 8 spored, thick-walled, 70-150 × 20-30 µm, among a fibrous mucilaginous mass of sterile tissues. Ascospores

hyaline to brown, 1-3(4) septate, constricted at the septum, 30-50 × 12-15 μm, with a rounded apex and a pointed base.

Macroconidial state: Conidiophores erect, simple, sometimes branched, cylindrical, septate, developing from the basal stroma, up to 200 μm long, forming conidia terminally. Conidiogenous cells monoblastic, terminal, cylindrical, percurrent. Conidia dry, solitary, hyaline to pale brown, Y-shaped, staurosporous, with a stalk cell and three arms when mature, arms 25-80 × 10-18 μm, continuous or septate, germinating by one to many germ tubes, formed in succession by proliferation of the conidiogenous cell.

Microconidial state: Similar to that found in *Perisporiopsis* species. Conidiophores erect, simple or branched, flexuous, olivaceous brown, paler towards the apex, 100-300 × 6-8 μm arising from the cells of the basal stroma. Conidiogenous cells denticulate, polyblastic, cylindrical, simple. Conidia solitary, dry, subglobose, pointed at the base, 6-8 μm broad, formed on a short denticle.

On leaves of *Daniella oliveri*. Africa.

A detailed account on the development of this species is given by C. & M. Moreau (1955). An anamorph of this type is also seen in *Perisporiopsis lophirae* (Deighton) v. Arx which differs from this species by 1-septate ascospores, in the presence of external mycelium and in the absence of a stroma.

MELIOLINA H. & P. Sydow, *Annls mycol.* **12:** 553, 1914.

Type sp.: *M. cladotricha* (Lév.) H. & P. Sydow, *Annls mycol.* **12:** 553, 1914.

Anamorph: Similar to *Phialophora* sect. Catenulatae but the conidiophores are very darkly pigmented, thick-walled and dichotomously branched (Pirozynski, 1974).

About seven species (Pirozynski, 1974), foliicolous, restricted to host members of the families Myrtaceae, Dilleniaceae, Myrsinaceae and Lauraceae. Africa, Australasia and Hawaii.

Colonies hypophyllous, black, densely velutinous. Superficial mycelium composed of pale to dark brown, septate hyphae with mostly one celled, globose, ovoid or cylindrical, straight or curved stomatopodia entering the leaf through the stoma to form internal mycelial hyphae. Pseudothecia solitary, immersed in the colonies, black, globose, becoming flattened dorsiventrally with an apical pore and bearing simple, rigid, straight, brown hyphae on the upper surface.

The pseudothecial wall is composed of thick-walled, dark brown cells on the outside and thin-walled, flattened cells towards the inside. Asci broadly clavate, ovoid or saccate, thick-walled, evanescent, 6-8 spored. Ascospores dark brown, thick-walled, mostly 3 septate, in one species 4 septate, large, with end cells capped by conical to lenticular black, opaque 'plugs' and two narrow subhyaline bands near the base and just below the plug, septa markedly thickened. Interthecial filaments mucose.

Conidiophores crowded, numerous, setiform, erect, very dark opaque brown, dichotomously branched, thick-walled, paler towards the phialidic apices. Phialides narrowly obclavate to lageniform, pale brown, wide in the middle, narrow at the neck, flaring out into a cup shaped collarette. Conidia formed singly within the collarettes, hyaline to subhyaline, cuneiform, spherical, with a truncate base, sometimes conidia accumulate into a slime ball.

Key to Meliolina with anamorphs

Ascospores 70-85 × 23-28 μm..... *M. shepherdii*

Ascospores 45-69 × 13-23 μm..... *M. mollis*

Ascospores 43-53 × 12.5-16 μm..... *M. cladotricha*

M. cladotricha (Lév.) H. & P. Sydow, *Annls mycol.* **12:** 553, 1914. (Fig. 31).

Meliola cladotricha Lév., *Ann. Sci. Nat.* III, **5:** 266, 1846.
Meliola octospora Cooke, *Grevillea* **11:** 38, 1882.
Meliola arborescens H. & P. Sydow, *Annls mycol.* **11:** 256, 1913.
Meliolina arborescens (H. & P. Sydow) H. & P. Sydow, *Annls mycol.* **12:** 553, 1914.
Meliolina radians H. & P. Sydow, *Annls mycol.* **12:** 553, 1914.
Meliolina yatesii H. & P. Sydow, *Annls mycol.* **15:** 195, 1917.
Meliolina octospora (Cooke) Höhnel, *Sber. Akad. Wiss. Wien* **128:** 557, 1919.
Meliolinopsis yatesii (H. & P. Sydow) Beeli. *Bull. Jard. Bot. Etat. Bruxelles* **7:** 101, 1920.
Meliolinopsis octospora (Cooke) Beeli, *Bull. Jard. Bot. Etat. Bruxelles* **7:** 101, 1920.
Meliolina sydowiana F. Stev., *Bull. Bishop Mus. Hawaii* **19:** 46, 1925.

Colonies hypophyllous. Pseudothecia up to 350 μm broad, setose. Asci 100-140 × 30-45 μm. Ascospores 3 septate, 43-53 × 12.5-16 μm, with smaller end cells.

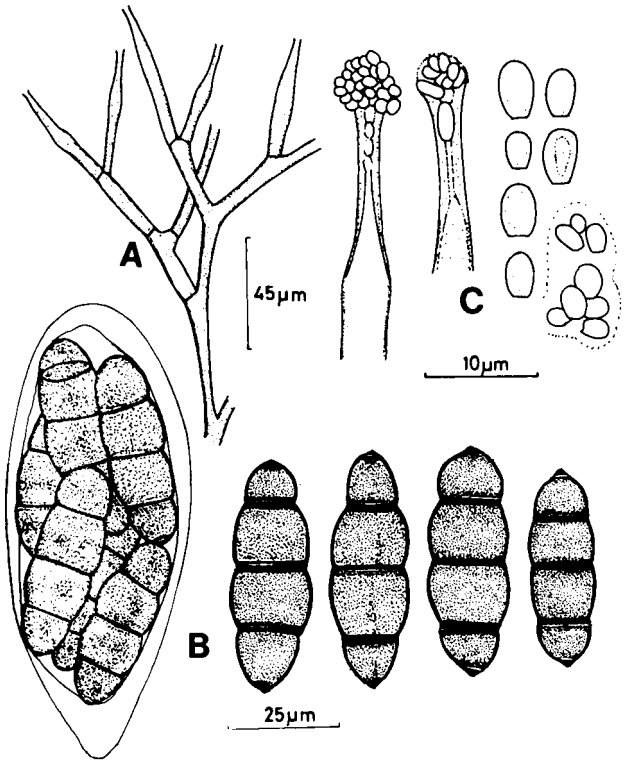


Fig. 31. *Meliolina cladotricha.* A, hyphae with conidiophores; B, ascus and ascospores; C, conidiophores and conidia.

Phialides 25-70 × 6-7 µm. Conidia 4-5 × 2.5-3 µm, very pale brown, usually aggregated into a slime ball.

On leaves of *Eugenia, Syzygium.* Australia, India, Philippines.

M. mollis (Berk. & Br.) Höhnel, *Sber. Akad. Wiss. Wien* **128:** 557, 1919 (Figs. 32 & 33, A,B).

Meliola mollis Berk. & Br., *J. Linn. Soc. Lond.* **14:** 136, 1875.
Dimerosporium mollis (Berk. & Br.) Sacc., *Syll. Fung.* **1:** 53, 1882.
Meliola pulcherrima H. & P. Sydow, *Annls mycol.* **11:** 254, 1913.
Meliolina pulcherrima (H. & P. Sydow) H. & P. Sydow, *Annls mycol.* **12:** 553, 1914.
Meliolina novae-zelandiae Hansf., *Proc. Linn. Soc. N.S.W.* **79:** 99, 1954.

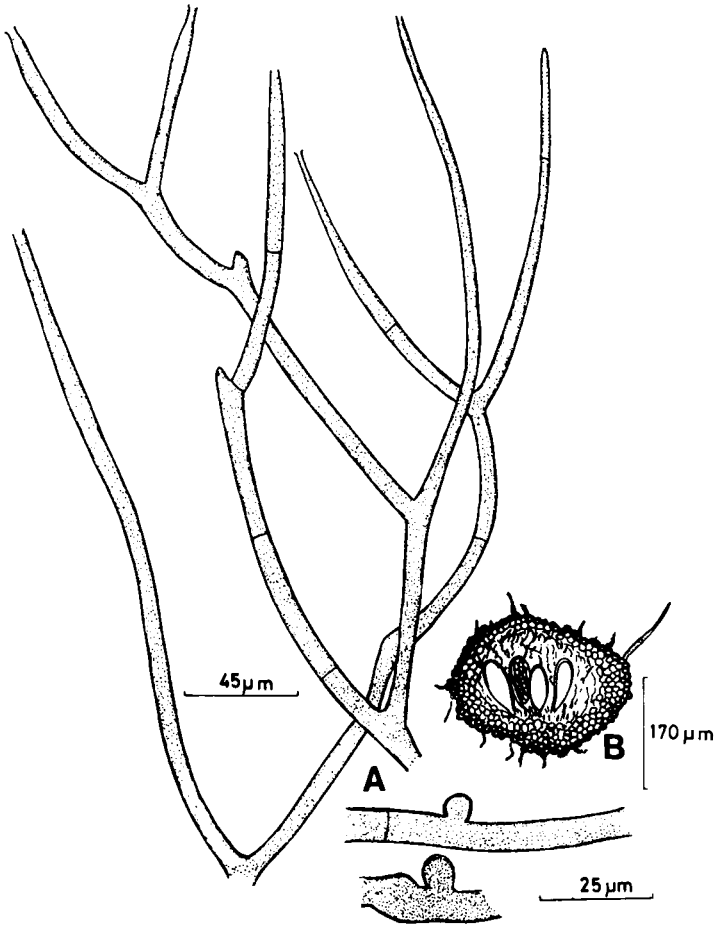


Fig. 32. *Meliolina mollis* (type). A, hyphae with conidiophores; B, v.s. pseudothecium.

Colonies hypophyllous. Pseudothecia up to 300 µm high with setae over the upper surface. Asci broadly clavate to ovoid or saccate, 6-8 spored 130-150 × 40-50 µm. Ascospores 3 septate, slightly constricted at the septa, 45-69 × 13-23 µm, with equal cells.

Phialides 25-70 × 6.5-7.5 µm wide in the middle, narrowed to about 2.5 µm at the neck and then flaring out into a cup-shaped collarette about 3.5 µm wide. Conidia 4-5.6 × 2.2-2.5 µm, usually aggregated into a slime ball.

On *Eugenia, Leptospermum, Syzygium.* Burma, India, New Zealand, Philippines, Sri Lanka.

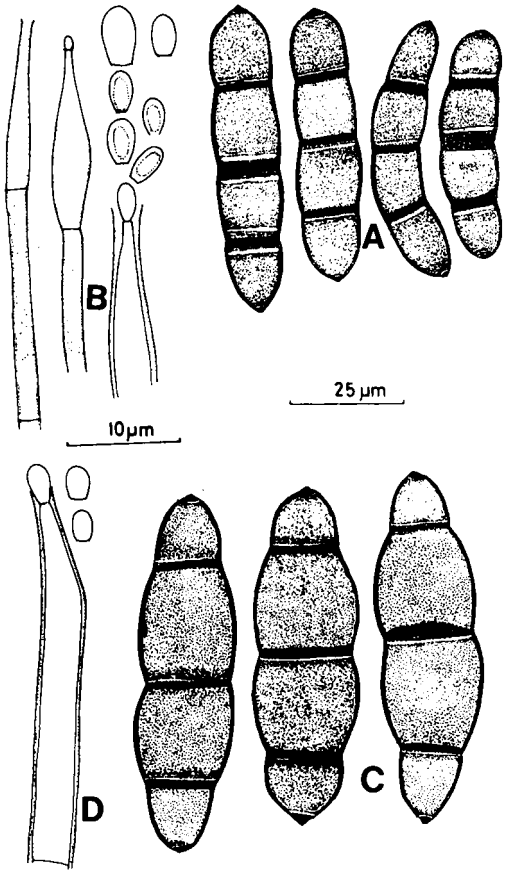


Fig. 33. *Meliolina mollis.* A, ascospores; B, conidiophores and conidia. *M. shepherdii.* C, ascospores; D, conidiophore and conidia.

M. shepherdii Hansf., *Proc. Linn. Soc. Lond.* **157:** 152, 1946 (Fig. 33 C,D).

Colonies hypophyllous. Pseudothecia up to 400 µm broad. Ascospores 3 septate, 70-85 × 23-28 µm, constricted at the septa.

Phialides and conidia similar to *M. mollis.*

On *Eugenia cotinifolia.* Mauritius.

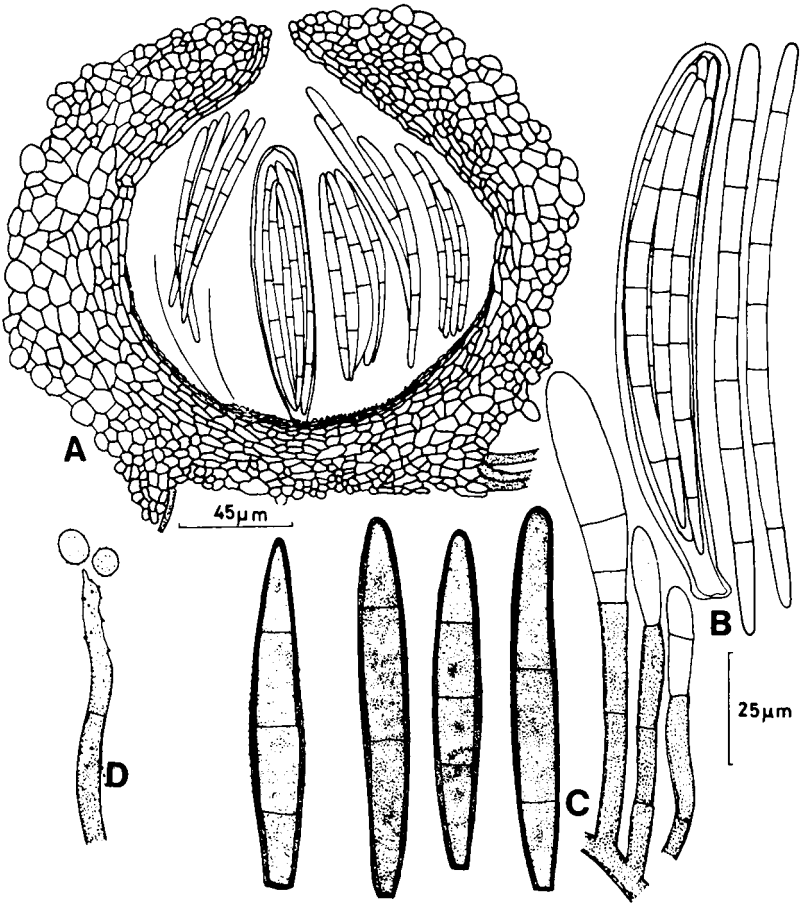


Fig. 34. *Ophioparodia pulchra* (type). A, v.s. pseudothecium; B, ascus and ascospores; C, conidiophores and conidia of *Septoidium* state; D, conidiophores and microconidia.

OPHIOPARODIA Petrak & Cif., *Annls mycol.* **30:** 223, 1932.

The genus is monotypic.

O. pulchra Petrak & Cif., *Annls mycol.* **30:** 223, 1932 (Fig. 34).

Anamorphs: *Septoidium* sp. and unnamed hyphomycete with unicellular conidia formed on short denticulate conidiogenous hyphae as in *Perisporiopsis.*

Colonies hypophyllous. Mycelium superficial, mostly widely effused, composed of dense reticulately branched, brown to dark brown, 2.5-5 μm thick hyphae. Pseudothecia superficial, globose, 180-200 μm broad, with an apical pore formed by gelatinization at maturity. The pseudothecial wall 40-50 μm thick is composed of angular to partly compressed, dark brown, pseudoparenchymatous cells. Asci numerous, cylindric clavate, short-stalked, 8 spored, 95-135 × 17-24 μm. Ascospores parallel in the ascus, cylindric fusiform, sometimes more or less cylindric-clavate, slightly curved, rarely straight, (5)-7 septate, not constricted at the septa, subhyaline, 83-133 × 5-6 μm. Pseudoparaphyses mucose at an early stage.

Septoidium conidia 3 septate, smooth to echinulate, 70-90 × 4-6 μm. Microconidia spherical, up to 6 μm diam.

On living leaves of *Tetragastris balsamifera*. Dominican Republic.

PERISPORIOPSIS Henn., *Hedwigia* **43:** 83, 1904.

Perisporina Henn., *Hedwigia* **43:** 357, 1904.
Parodiopsis Maubl. in Arnaud, *Bull. Soc. mycol. Fr.* **31:** 22, 1915.
Dichothrix Theiss., *Beih. Bot. Centralbl.* **29:** 60, 1912 non Zanard.
Piline Theiss., *Annls mycol.* **14:** 409, 1917 (1916).
Hypoplegma Theiss. & H. Sydow, *Annls mycol.* **15:** 135, 1917.
Chrysomyces Theiss. & H. Sydow, *Annls mycol.* **15:** 139, 1917.
Schistodes Theiss., *Annls mycol.* **15:** 456, 1918.
Meliolidium Speg., *Bol. Acad. Nac. Cien. Córdoba* **26:** 336, 1923.

(after Müller & von Arx, 1962).

Type sp.: *P. struthanthi* Henn., *Hedwigia* **43:** 83, 1904.

Anamorphs: *Septoidium* Arnaud (= *Diploidium* Arnaud) and an unnamed hyphomycete with smaller unicellular conidia formed on short denticulate conidiogenous hyphae.

Colonies amphigenous, mostly hypophyllous, effuse, brown, reddish brown to dark brown. Mycelium superficial, anastomosing to form a close network with simple or lobed stomatopodia with one to many hyphae penetrating the stomata. Internal mycelium hyaline, septate, intercellular, forming haustoria in the mesophyll cells. Pseudothecia superficial on mycelium, initially with orange red to reddish pigments, scattered usually in concentric rings, solitary, globose to subglobose, non ostiolate, but irregularly dehiscent above by gelatinization at maturity, usually mixed with conidiophores. Asci few, ovoid, cylindrical to cylindric-clavate, 4-8, mostly 8 spored, sessile to short-stalked, thickened at the apex. Ascospores 1-5 septate, initially hyaline, later

pale brown to brown, constricted or not constricted at the septa, conglobate or bi or tri-seriate in the ascus, smooth to faintly verruculose, oblong, ovoid, ellipsoidal clavate or clavate-ellipsoidal, with rounded ends. Pseudoparaphyses inconspicuous or absent.

Septoidium: Conidiophores simple or branched, straight or flexuous, smooth, pale brown to brown with paler apex. Conidiogenous cells monoblastic, cylindrical, terminal, percurrent, anellidic. Conidia solitary, dry, simple, clavate, cylindrical or cymbiform, rounded or almost ellipsoidal at the apex, truncate at the base, initially hyaline, later pale brown to red or dark brown, one or more septate, formed at the tip of the conidiophore.

There is no available name for the other hyphomycete anamorph. Conidiophores erect, simple or branched, septate, pale brown to dark brown or reddish brown, paler at the apex, with scattered, short, projecting denticles on the upper part. Conidiogenous cells denticulate, polyblastic, integrated, sympodial, cylindrical, terminal and intercalary, denticles small. Conidia dry, ellipsoidal to spherical, one celled, hyaline to pale brown, smooth to lightly echinulate, sometimes apiculate at the base, borne on short denticles at the upper part of the conidiophore.

Most of the species has been described and some illustrated by Arnaud (1921, 1923), Hansford (1946a), Baker (1955) and Müller and von Arx (1962). They are all foliicolous parasites of forest trees and shrubs in the South and Central American tropics and tropical Africa.

Key to Perisporiopsis species with anamorphs

Ascospores always one septate, conidia transversely multiseptate or staurosporous 1

Ascospores one to many septate, conidia transversely multiseptate..... 6

1. Conidia staurosporous..... 2

   Conidia straight..... 3

2. Ascospores 25-33 × 7-12 μm, conidia 50-100 × 10-16 μm..... *P. lophirae*

   Ascospores 30-52 × 10-15 μm, conidia 50-140 × 28-56 μm. *P. brachystegiae*

3. Conidia 1-2 septate..... 4

   Conidia 2-3 septate..... 5

4. Ascospores 35-45 × 20-24 μm, conidia 40-63 × 17-21 μm.... *P. escharoides*

   Ascospores 40-45 × 10-13.5 μm, conidia 40-56 × 13-16 μm.... *P. torrendii*

   Ascospores 36-52 × 13-20 μm, conidia 60-65 × 18-20 μm..... *P. sydowii*

Ascospores 40-50 × 11-15 μm, conidia 57-68 × 12-15 μm.... *P. kwangensis*

Ascospores 36-51 × 12-15 μm, conidia 36-45 × 15-20 μm..... *P. cecropiae*

Ascospores 40-55 × 12-16 μm, conidia 60-80 × 12-15 μm... *P. megalospora*

Ascospores 55-66 × 17-21 μm, conidia 56-80 × 23-38 μm..... *P. hurae*

Ascospores 30-75 × 16-21 μm, conidia 55-79 × 12-16 μm.... *P. melioloides*

5. Ascospores 27-38 × 12-15 μm, conidia 50-72 × 12-14 μm.... *P. brasiliensis*

Ascospores 45-60 × 12-16 μm, conidia 62-80 × 16-22 μm..... *P. clusiae*

6. Ascospores 1-5 septate, 52-86 × 11-15 μm, conidia 65-100 × 14-17 μm..... ..... *P. struthanthi*

Ascospores 1-3 septate..... 7

7. Ascospores 50-70 × 9-12 μm, conidia 50-77 × 12-14 μm..... *P. fusispora*

Ascospores 60-82 × 9-14 μm, conidia 80-100 × 15-18 μm.. *P. portoricensis*

P. brachystegiae (Henn.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 173, 1962 (Fig. 35).

Parodiella brachystegiae Henn., *Engler Bot. Jahrb.* **28:** 235, 1900.
Dimerosporium erysiphinum Henn. in Baum., *Sambesi Exp.*: 164, 1902.
Dimerium erysiphinum (Henn.) Sacc., *Syll. Fung.* **17:** 537, 1905.
Dimerosporium berliniae Pat. & Har., *Bull. Soc. mycol. Fr.* **24:** 15, 1908.
Dichothrix erysiphina (Henn.) Theiss., *Beih. Bot. Centralbl.* **2:** 29, 1912.
Schistodes erysiphina (Henn.) Theiss., *Annls mycol.* **15:** 456, 1918(1917).
Chrysomyces brachystegiae (Henn.) Theiss. & H. Sydow, *Annls mycol.* **15:** 139, 1917.
Parodiopsis berliniae (Pat. & Har.) Arnaud, *Annls École nat. d'Agric. Mont.* **16:** 22, 1918.
Parodiopsis brachystegiae (Henn.) Arnaud, *Annls Epiphyt.* **7:** 68, 1921.

Anamorph: *Triposporium copaiferum* Bat. & Farr in Bat. & da Matta, *Broteria* **28:** 89, 1959.

Colonies hypophyllous. Pseudothecia up to 180 μm broad. Asci 60-75 × 32-45 μm. Ascospores one septate, 30-52 × 10-15 μm, rarely with an additional septum.

Conidiophores erect, simple, continuous or septate, sometimes branched, often swollen at the base, arising laterally or terminally on the hyphae, 22-90 × 8-12 μm. Conidiogenous cells monoblastic, terminal, cylindrical, percurrent. Conidia dry, solitary, hyaline to subhyaline, Y-shaped, staurosporous, with a stalk cell and three arms when mature, arms simple or one septate, 50-140 × 28-56 μm, with rounded or obtuse apices. Stalk cell 20-30 μm long. Similar type of ana-

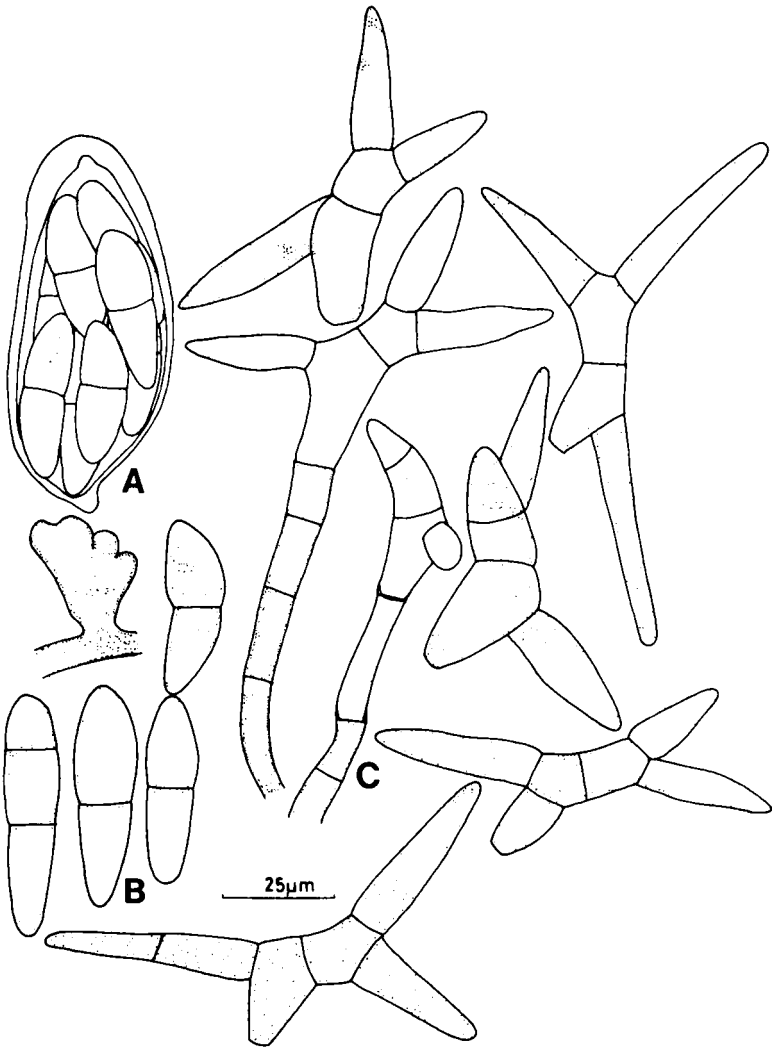


Fig. 35. *Perisporiopsis brachystegiae* (type). A, ascus; B, ascospores; C, conidiophores and conidia.

morph is also seen in *Chevalieropsis* where it is formed on a basal stroma. Microconidial form not present.

On *Brachystegia, Berlinia, Copaifera* and other Leguminoseae.
Africa.

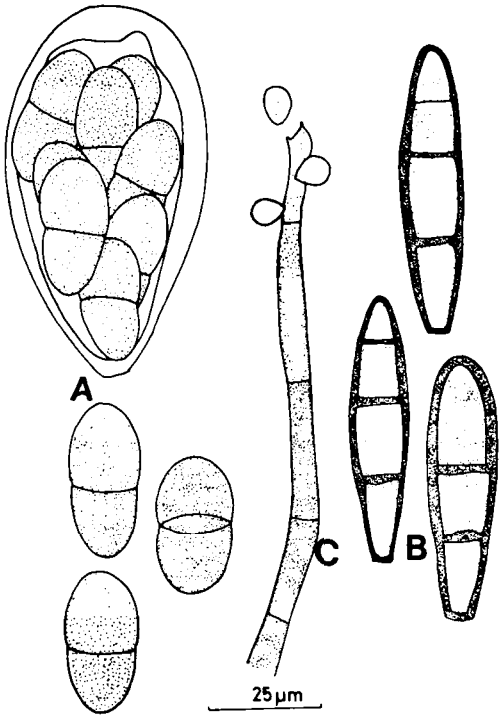


Fig. 36. *Perisporiopsis brasiliensis* (type). A, ascus and ascospores; B, *Septoidium* conidia; C, conidiophore and microconidia.

P. brasiliensis (Bat. & Nascim.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962 (Fig. 36)

Parodiopsis brasiliense Bat. & Nascim., *An. Soc. Biol. Pernamb.* **14:** 121, 1956.

Pseudothecia up to 225 µm broad, somewhat fleshy, brownish red. Asci 87-113 × 47-62 µm. Ascospores one septate, brown when mature, constricted at the septum, 27-38 × 12-15 µm.

Septoidium conidia clavate to navicular, 2-3 septate, hyaline to olivaceous brown, 50-72 × 12-14 µm. Microconidia ovoid to limeniform, hyaline, 5-7.5 × 4-6.5 µm.

On *Tapirira guyanensis*. Brazil.

P. cecropiae (Baker) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962 (Fig. 37).

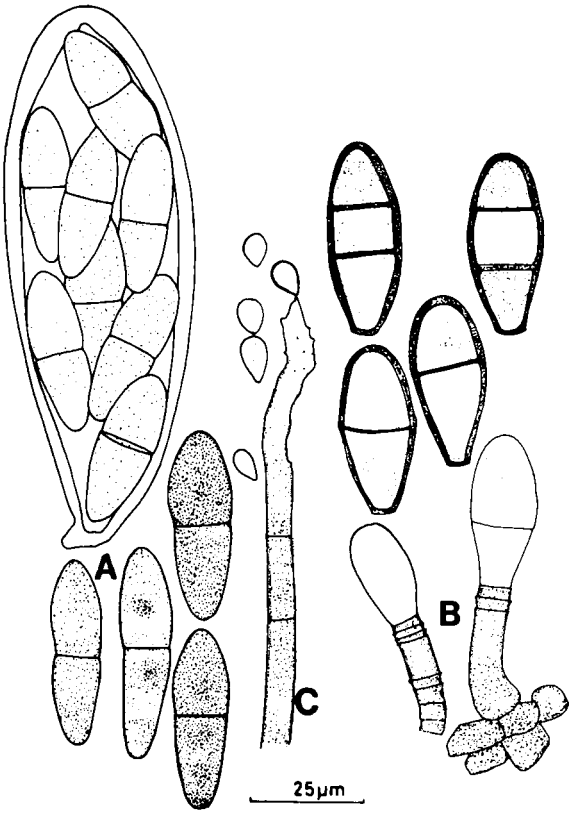


Fig. 37. *Perisporiopsis cecropiae* (type). A, ascus and ascospores; B, conidiophores and conidia of *Septoidium* state; C, conidiophore and microconidia.

Parodiopsis cecropiae Baker, *Mycol. Pap.* **58:** 9, 1955.

Colonies hypophyllous, concentrically zoned. Pseudothecia up to 200 µm broad, orange red to dark brown. Asci 90-135 × 36-45 µm. Ascospores one septate, slightly constricted at the septum, hyaline to brown, 36-51 × 12-15 µm.

Septoidium conidia brown, 1-2 septate, 36-45 × 15-20 µm. Microconidia 5-7.5 × 3-4 µm.

On *Cecropia peltata*. Trinidad.

Baker (1955) described a variety, *P. cecropiae* var. *sterculiae* on *Sterculia caribea* which is morphologically similar to *P. cecropiae* but differs only in the host plant.

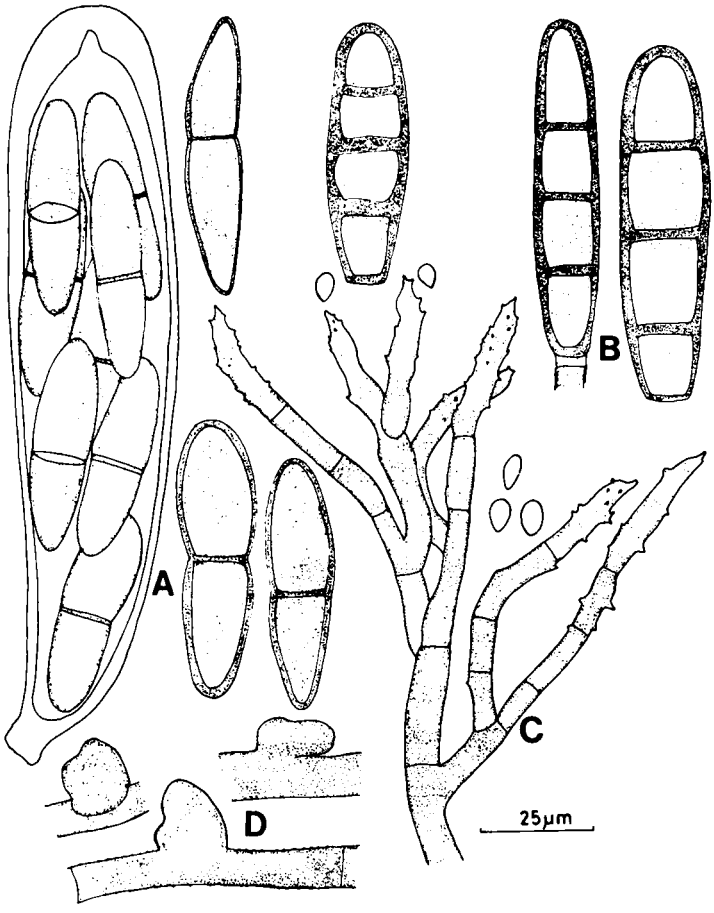


Fig. 38. *Perisporiopsis clusiae* (type). A, ascus and ascospores; B, *Septoidium* conidia; C, conidiophores and microconidia; D, stomatopodia.

P. clusiae (Baker) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962 (Fig. 38).

Parodiopsis clusiae Baker, *Mycol. Pap.* **58:** 2, 1955.

Colonies irregularly rounded to confluent. Pseudothecia dark brown, up to 280 µm broad. Asci 100-190 × 40-50 µm. Ascospores one septate, 45-60 × 12-16 µm.

Septoidium conidia 3 septate, hyaline to pale brown, 62-80 × 16-22 µm. Microconidia ovoid, hyaline, 6-8 × 2-3 µm.

On *Clusia rosea*. Central and South America.

Hansford (1957) described *Parodiopsis clusiicola* on *Clusia krugiana* from Puerto Rico with 1-2 septate ascospores measuring 50-75 × 18-24 μm. *Septoidium* conidia 2-3 septate, 74-92 × 16-22 μm, and microconidia 10-12 × 5-6 μm. This is *Perisporiopsis* and is redisposed as *Perisporiopsis clusiicola* (Hansf.) comb. nov.

P. escharoides (H. Sydow) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 174, 1962 (Fig. 39 A,B)

Henningsomyces escharoides H. Sydow, *Annls mycol.* **23:** 331, 1925.
Parodiopsis escharoides (H. Sydow) Hansf., *Proc. Linn. Soc. Lond.* **157:** 143, 1946.

Pseudothecia dark brown, up to 200 μm broad. Asci 75-90 × 40-51 μm. Ascospores one septate, pale brown to dark brown, constricted at the septum, oblong to ellipsoidal, 35-45 × 20-24 μm, often with a slightly narrower lower cell.

Septoidium conidia oblong clavate to oblong fusoid, two septate, dark brown, 40-63 × 17-21 μm. Microconidia not present.

On *Mauria biringo*. Costa Rica.

P. fusispora (Pat.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 172, 1962 (Fig. 40).

Zukalia fusispora Pat., *Bull. Soc. mycol. Fr.* **8:** 130, 1892.
Asteronia sweetiae Henn., *Hedwigia* **34:** 104, 1895.
Asteridium elegantissimum Rehm, *Hedwigia* **40:** 157, 1901.
Parodiella nigrescens Rehm, *Hedwigia* **40:** 154, 1901.
Parodiella viridescens Rehm var. *ingarum* Henn., *Hedwigia* **43:** 358, 1904.
Perisporina manaosensis Henn., *Hedwigia* **43:** 357, 1904.
Henningsomyces nigrescens (Rehm) Theiss. & H. Sydow, *Annls mycol.* **15:** 137, 1817.
Parodiopsis sweetiae (Henn.) Arnaud, *Annls École nat. d'Agric. Mont.* **16:** 22, 1918.
Parodiopsis ingarum (Henn.) Arnaud, *Annls École nat. d'Agric. Mont.* **16:** 25, 1918.
Parodiopsis ingarum (Henn.) Arnaud var. *rubra* Arnaud, *Annls Epiphyt.* **9:** 20, 1923.
Parodiopsis stevensii Arnaud, *Annls Epiphyt.* **9:** 22, 1923.
Perisporium truncatum (F. Stev.) Arnaud, *Annls Epiphyt.* **9:** 33, 1923.
Parodiopsis bicoronata Orejuala, *Mycologia* **36:** 433, 1944.
Parodiopsis rubra (Arnaud) Baker & Dale, *Mycol. Pap.* **33:** 8, 1950.

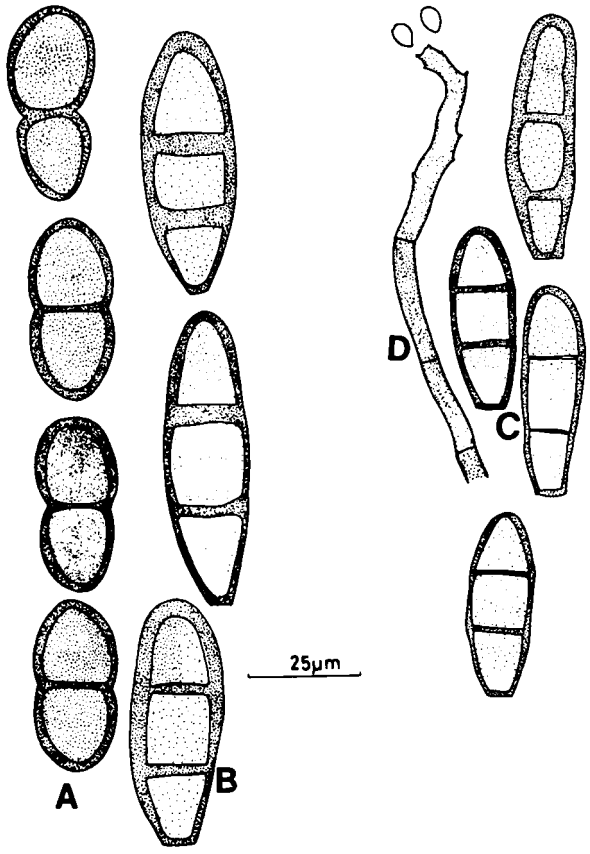


Fig. 39. *Perisporiopsis escharoides* (type). A, ascospores; B, *Septoidium* conidia. *P. torrendii.* C, *Septoidium* conidia; D, conidiophores and microconidia.

Anamorph: *Septoidium stevensii* Arnaud, *Annls Epiphyt.* **9:** 34, 1923.
Diploidium sweetiae Arnaud, ibid.: **33,** 1923.
Diploidium mitratum Arnaud, ibid.

Pseudothecia up to 210 µm broad, yellowish green, orange red to black. Asci 70-90 × 30-40 µm. Ascospores fusoid, 1-3 septate, 50-70 × 9-12 µm.

Septoidium conidia 2-3 septate, fusoid, 50-77 × 12-14 µm. Microconidia hyaline, ovoid, 4-10 × 4-6 µm.

On *Calliandra, Inga, Sweetia* and other Leguminoseae. Central and South America.

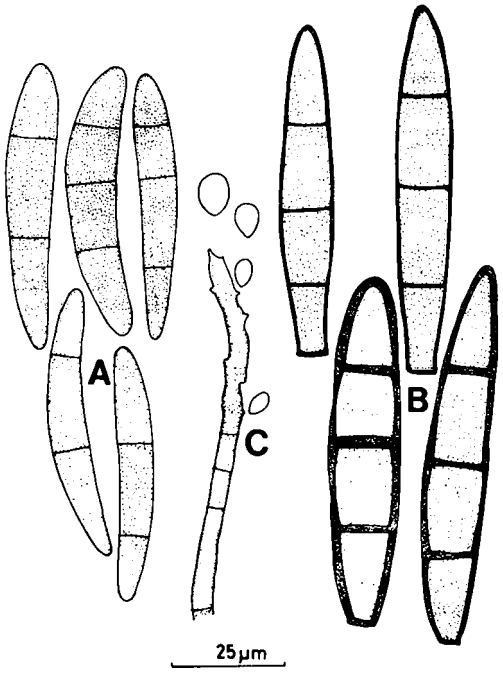


Fig. 40. *Perisporiopsis fusispora* (type). A, ascospores; B, *Septoidium* conidia; C, conidiophore and microconidia.

P. hurae (Baker & Dale) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 174, 1962 (as '*urae*') (Fig. 41).

Parodiopsis perae Arnaud var. *hurae* Arnaud, *Annls Epiphyt.* **9:** 16, 1923 (as '*urae*')
Parodiopsis hurae (Arnaud) Baker & Dale, *Mycol. Pap.* **33:** 9, 1950 (as '*urae*').

Anamorph: *Septoidium hurae* (Henn.) Arnaud, *Annls Epiphyt.* **9:** 33, 1923 (as '*urae*').

Helminthosporium hurae Henn., *Hedwigia* **43:** 394, 1904.
Sporhelminthium hurae (Henn.) Speg., *Physis* **4:** 292, 1918.

Pseudothecia up to 220 µm broad. Asci 90-120 × 42-54 µm. Ascospores one septate, brown when mature, 55-66 × 17-21 µm, often with the lower cell narrowing to an acute end.

Septoidium conidia two septate, broadly fusoid, 56-80 × 23-38 µm. Microconidia 2.5-4 × 2-2.5 µm.

On *Hura crepitans*. Tropical America.

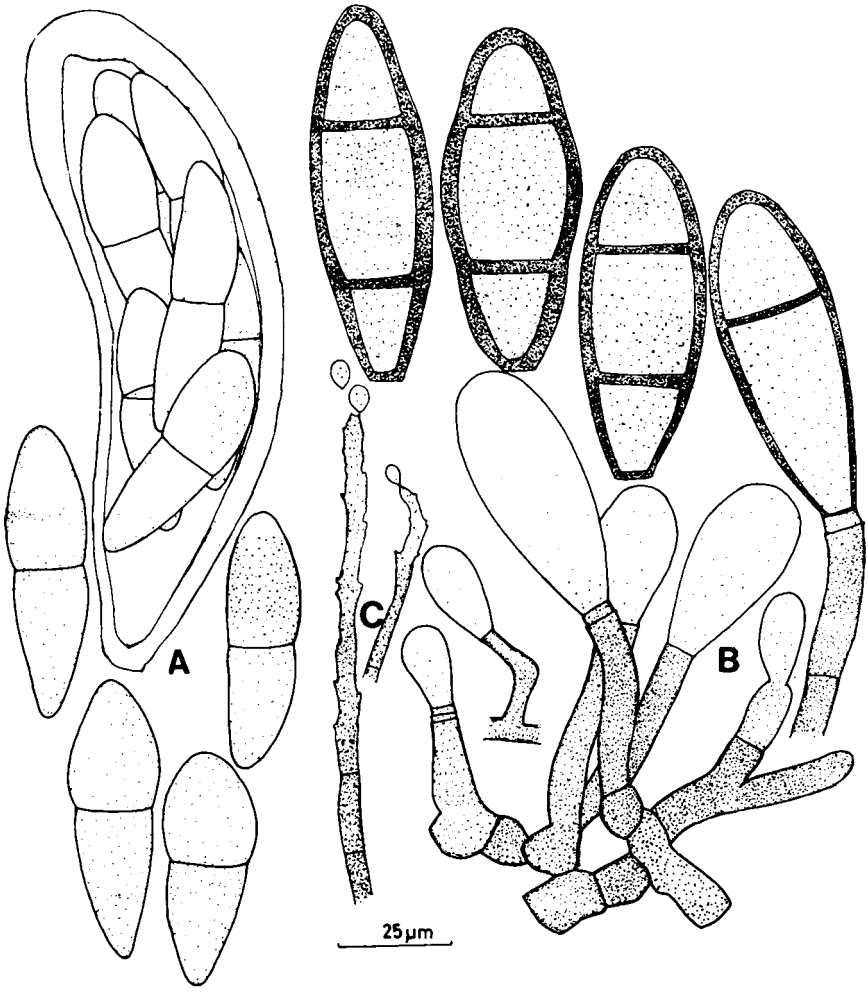


Fig. 41. *Perisporiopsis hurae* (type). A, ascus and ascospores; B, conidiophores and conidia of *Septoidium* state; C, conidiophores and microconidia.

P. kwangensis (Henn.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 174, 1962 (Fig. 42).

Parodiella kwangensis Henn., *Flore Bas. & Moyen, Congo* **3:** 225, 1908.
Parodiopsis kwangensis (Henn.) Hansf., *Sydowia Beih.* **1:** 86, 1957.
Parodiopsis perae Arnaud, *Annls Epiphyt.* **7:** 59, 1921.

Anamorph: *Septoidium lateritium* (H. & P. Sydow) Arnaud, *Annls Epiphyt.* **7:** 106, 1921.

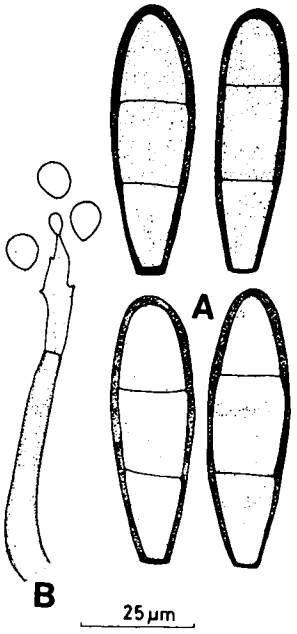


Fig. 42. *Perisporiopsis kwangensis.* A, *Septoidium* conidia; B, conidiophore and microconidia.

Exosporium lateritium H. & P. Sydow, *Annls mycol.* **11:** 407, 1913.
Helminthosporium kwangense Henn., *Flore Bas. & Moyen, Congo* **3:** 231, 1908.

Pseudothecia brownish red in concentric rings, up to 240 µm broad. Asci 84-114 × 30-40 µm. Ascospores one septate, brown when mature, 40-50 × 11-15 µm.

Septoidium conidia two septate, brown at maturity, 57-68 × 12-15 µm. Microconidia 5-9 × 2-3 µm.

On *Alchornea, Pera, Sapium* and other Euphorbiaceae. Africa and South America.

P. lophirae (Deighton) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962 (Fig. 43).

Parodiopsis lophirae Deighton in Petrak & Deighton, *Sydowia* **6:** 315, 1952.

Pseudothecia up to 140 µm broad. Asci 62-75 × 25-30 µm. Ascospores one septate, 25-33 × 7-12 µm.

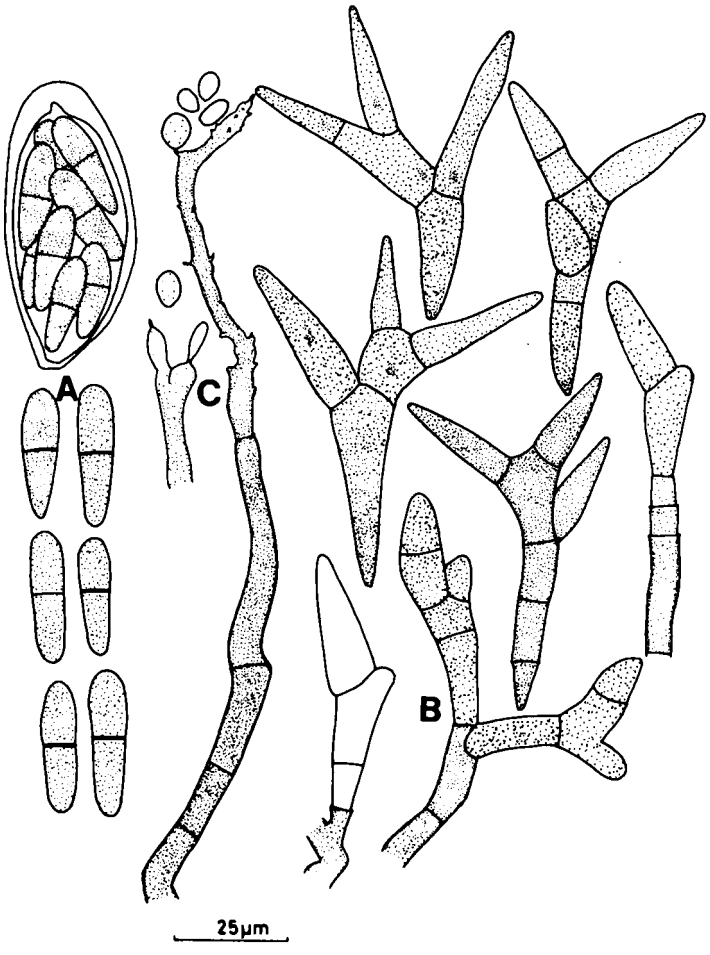


Fig. 43. *Perisporiopsis lophirae*. A, ascus and ascospores; B, conidiophores and conidia; C, conidiophores and microconidia.

Staurosporous conidia 50-100 × 10-16 µm, with a stalk cell and three arms very similar to that found in *P. brachystegiae*. Microconidia hyaline, subglobose to ovate, 8-11 × 6-9 µm, with an apiculate base, formed on polyblastic, denticulate conidiogenous cell.

On *Lophira alata*. Africa.

Moreau C. & M. (1959) have given a detailed account of the development of this species.

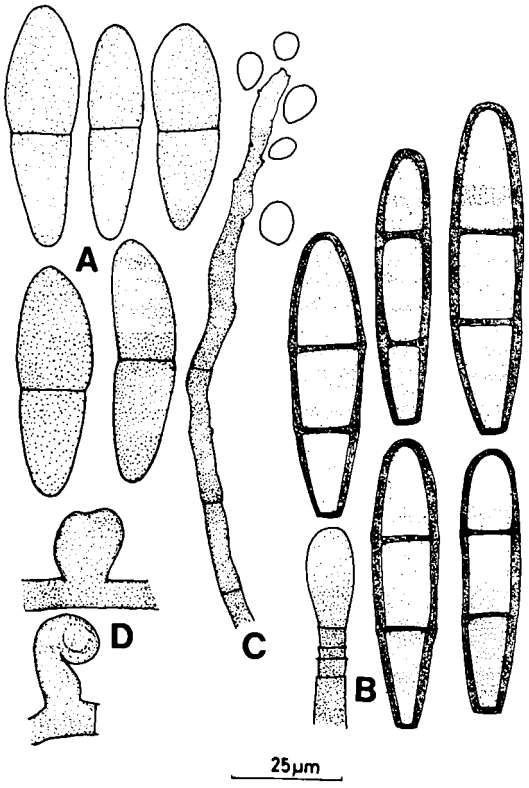


Fig. 44. *Perisporiopsis megalospora.* A, ascospores; B, conidiophore and conidia of *Septoidium* state; C, conidiophore and microconidia; D, stomatopodia.

P. megalospora (Sacc. & Berl.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 174, 1962 (Fig. 44).

Nectria megalospora Sacc. & Berl., *Fungi of Brazil:* 157, 1885.
Parodiella viridescens Rehm, *Hedwigia* **40:** 154, 1901.
Parodiopsis viridescens (Rehm) Maubl., *Bull. Soc. mycol. Fr.* **31:** 22, 1915.
Hypoplegma viridescens (Rehm) Theiss. & H. Sydow, *Annls mycol.* **15:** 135, 1917.
Parodiopsis megalospora (Sacc. & Berl.) Arnaud, *Annls Epiphyt.* **7:** 66, 1921.
Parodiopsis megalospora (Sacc. & Berl.) Arnaud var. *trinitensis* Arnaud, *Annls Epiphyt.* **9:** 18, 1923.
Parodiopsis megalospora (Sacc. & Berl.) Arnaud var. *viridescens* (Rehm) Baker, *Mycol. Pap.* **58:** 5, 1955.

Anamorph: *Septoidium trinitense* Arnaud, *Annls Epiphyt.* **9:** 34, 1923.

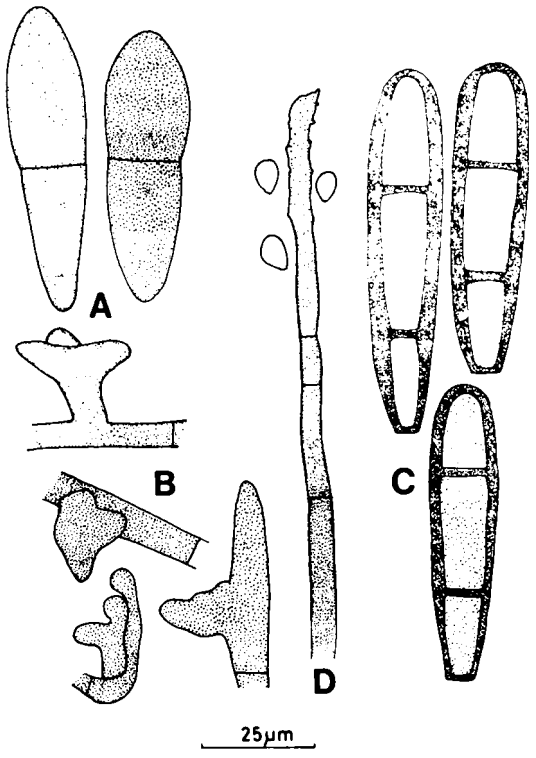


Fig. 45. *Perisporiopsis melioloides.* A, ascospores; B, stomatopodia; C, conidia of *Septoidium* state; D, conidiophore and microconidia.

Pseudothecia yellow to reddish brown, up to 200 µm broad. Asci 90-125 × 35-45 µm. Ascospores one septate, brown when mature, 40-55 × 12-16 µm. Ascospores one septate, brown when mature, 40-55 × 12-16 µm.

Septoidium conidia two septate, 60-80 × 12-15 µm. Microconidia 7-10 × 5-7 µm.

On *Banisteriopsis, Hiraea, Mascagnia, Tetrapteris* and other Malpighiaceae. South America.

P. melioloides (Berk. & M. A. Curtis) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 171, 1962 (Fig. 45).

Sphaeria melioloides Berk. & M. A. Curtis, *J. Linn. Soc. Lond.* **10:** 387, 1868.

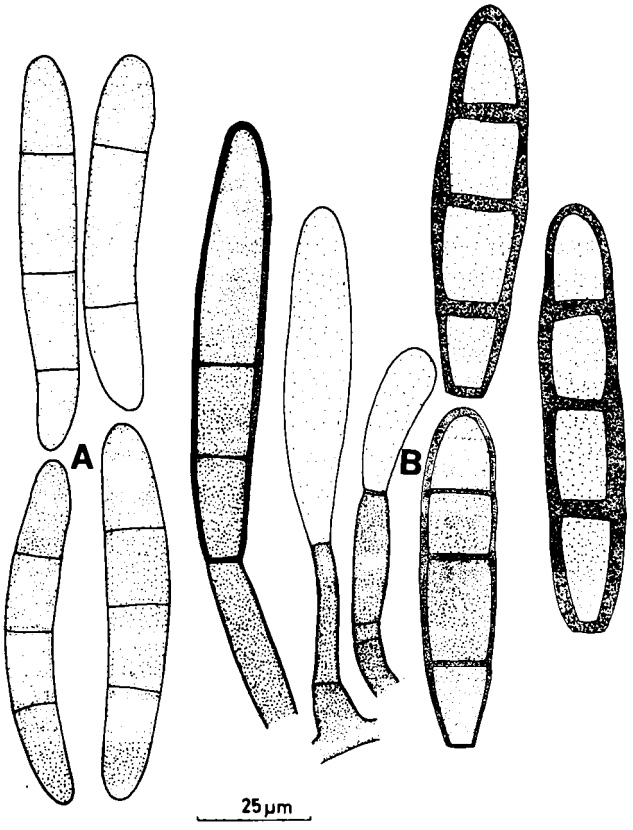


Fig. 46. *Perisporiopsis portoricensis.* A, ascospores; B, conidiophores and conidia of *Septoidium* state.

Rosellinia melioloides (Berk. & M. A. Curtis) Sacc., *Syll. Fung.* **1:** 276, 1882.
Parodiella melioloides (Berk. & M. A. Curtis) Winter in Rabenh., *Hedwigia* **24:** 257, 1885.
Dimerosporium urbanianum Henn., *Hedwigia* **33:** 231, 1894.
Parodiella consimilis Henn., *Hedwigia* **34:** 106, 1895.
Dimerium melioloides (Berk. & M. A. Curtis) Garmen, *Mycologia* **7:** 335, 1915.
Parodiopsis melioloides (Berk. & M. A. Curtis) Maubl., *Bull. Soc. mycol. Fr.* **31:** 23, 1915.
Parodiopsis melioloides (Berk. & M. A. Curtis) Arnaud, *Annls Epiphyt.* **7:** 62, 1921.

Anamorph: *Septoidium consimile* Arnaud, *Annls Epiphyt.* **7:** 107, 1921.

Pseudothecia rust coloured to brown, up to 150 µm broad. Asci 70-90 × 30-40 µm. Ascospores 30-75 × 16-21 µm, one septate.

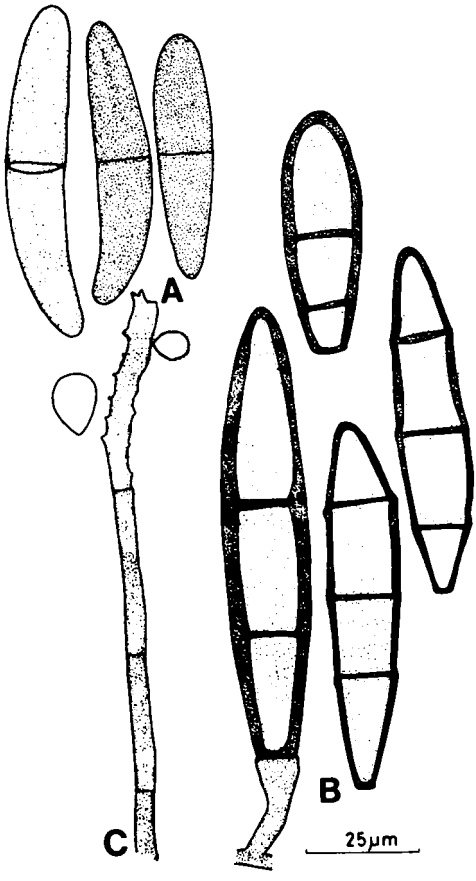


Fig. 47. *Perisporiopsis struthanthi* (type). A, ascospores; B, conidia of *Septoidium* state; C, conidiophore and microconidia.

Septoidium conidia two septate, 55-79 × 12-16 µm. Microconidia 4-7 × 3-5 µm.

On Myrtaceae and other plants. South America, Africa.

P. portoricensis (F. Stev.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962. (Fig. 46).

Perisporium portoricense F. Stev., *Trans. Illin. Acad. Sci.* **10:** 169, 1917.
Perisporina portoricensis (F. Stev.) Hansf., *Sydowia* **11:** 44, 1958.

Pseudothecia brown to black, up to 270 μm broad. Asci 110-125 × 40-50 μm. Ascospores 2-3 septate, cylindric to slightly clavate, yellow brown, 60-82 × 9-14 μm.

Septoidium conidia 3 septate, 80-100 × 15-18 μm. Microconidia ellipsoidal, hyaline, 8-12 × 5-7 μm, apiculate at the base.

On *Calophyllum calaba*. Puerto Rico.

P. struthanthi Henn., *Hedwigia* **43:** 83, 1904. (Fig. 47).

Parodiopsis struthanthi (Henn.) Arnaud, *Bull. Soc. mycol. Fr.* **31:** 23, 1915.
Perisporina struthanthi (Henn.) Hansf., *J. Linn. Soc. Lond.* **151:** 144, 1946.

Anamorph: *Septoidium struthanthi* Arnaud, *Annls Epiphyt.* **7:** 107, 1921.

Pseudothecia brown to dark brown, up to 200 μm broad. Asci 105-145 × 28-40 μm. Ascospores 1-5 septate, 52-86 × 11-15 μm.

Septoidium conidia 2-3 septate, 65-100 × 14-17 μm. Microconidia brown, 9-12 × 4-8 μm.

On *Struthanthus* and other Loranthaceae. South America.

P. sydowii (Petrak) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962 (Fig. 48).

Parodiopsis sydowii Petrak, *Sydowia* **4:** 517, 1950.

Pseudothecia up to 300 μm broad. Asci 90-130 × 32-48 μm. Ascospores one septate, 36-52 × 13-20 μm.

Septoidium conidia two septate, 60-65 × 18-20 μm. Microconidia 9-12 × 8-10 μm, smooth to echinulate.

On *Oryctanthus florulenta*. Ecuador.

P. torrendii (Bat. & Maia) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 175, 1962 (Fig. 39 C,D).

Parodiopsis torrendii Bat. & Maia in Bat., Maia & Vital, *An. Soc. Biol. Pernamb.* **15:** 437, 1957.

Pseudothecia dark brown to black, up to 250 μm brown. Asci 4-8 spored, 110-146 × 24-27 μm. Ascospores clavate, one septate, constricted at the septum, 40-45 × 10-13.5 μm.

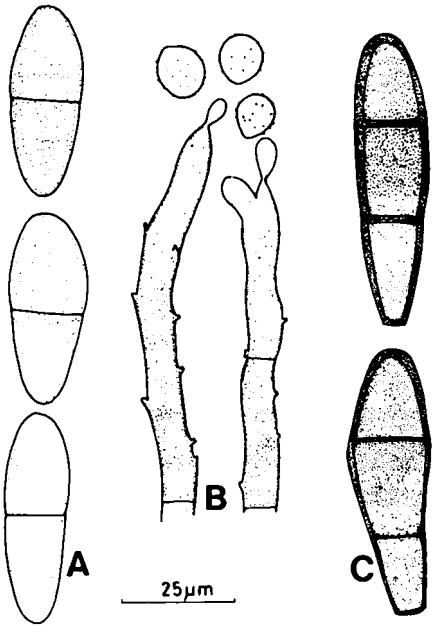


Fig. 48. *Perisporiopsis sydowii* (type). A, ascospores; B, conidiophores and microconidia; C, *Septoidium* conidia.

Septoidium conidia 1-2 septate, 40-56 × 13-16 µm. Microconidia 3-5 × 1.5-2.5 µm.

On *Buddleja* spp. Brazil.

PILGERIELLA Henn., *Hedwigia* **39:** (137), 1900.

Perisporiopsella Bat., Bezerra, Castrillón & Matta, *Publ. Inst. Micol. Univ. Recife* **431:** 4, 1964.

Type sp.: *P. perisporioides* Henn., *Hedwigia* **39:** (137), 1900.

Anamorphs: *Septoidium* Arnaud and microconidial state with one-celled small conidia as those found in *Perisporiopsis* Henn., *Chevalieropsis* Arnaud and *Ophioparodia* Petrak & Cif.

Colonies amphigenous, mostly hypophyllous, superficial, effused or orbicular. Mycelium superficial composed of branched, septate, olivaceous brown hyphae with stomatopodia, sometimes forming a thin parenchymatic or hyphal hypostroma. Pseudothecia scattered to aggre-

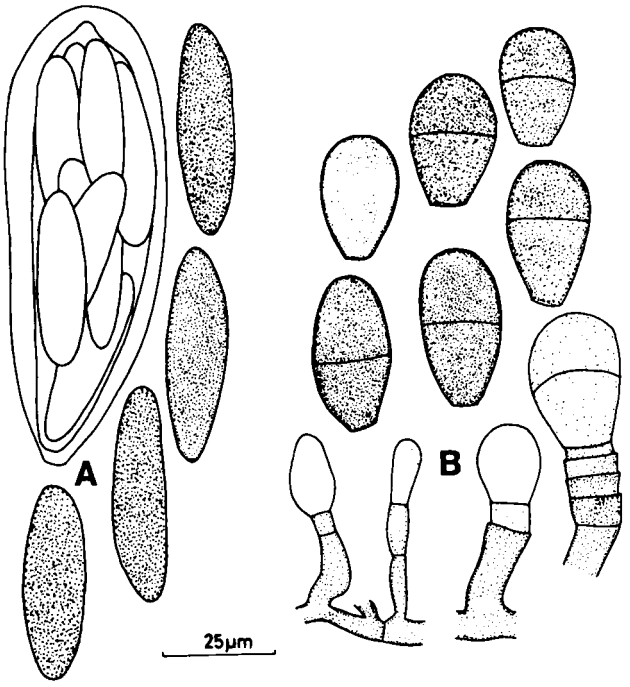


Fig. 49. *Pilgeriella anacardii* (type). A, ascus and ascospores; B, conidiophores and conidia of *Septoidium* state.

gated, mixed with conidiophores and sterile hyphal hairs or setae, dark brown, globose to subglobose, opening at the apex at maturity into a wide pore by rupture and gelatinization of the cells at the apex. The peridium is thin and pseudoparenchymatic, composed of moderately thick-walled polygonal cells. Asci ellipsoid to clavate, thickened at the apex, 8 spored. Ascospores obliquely uniseriate or biseriate, one-celled, initially hyaline with granular contents, later becoming pale brown to brown, broadly oblong, ellipsoidal or clavate. The interior of the cavity when young is filled with delicate tissue of hyaline cells which disintegrate and disappear as the asci mature.

Anamorphs same as described for *Perisporiopsis*. Only two species known and they are both leaf parasites.

Key to Pilgeriella species

Ascospores 35-52 × 16-22 µm, *Septoidium* conidia 27-40 × 16-22 µm.....
..... *P. anacardii*

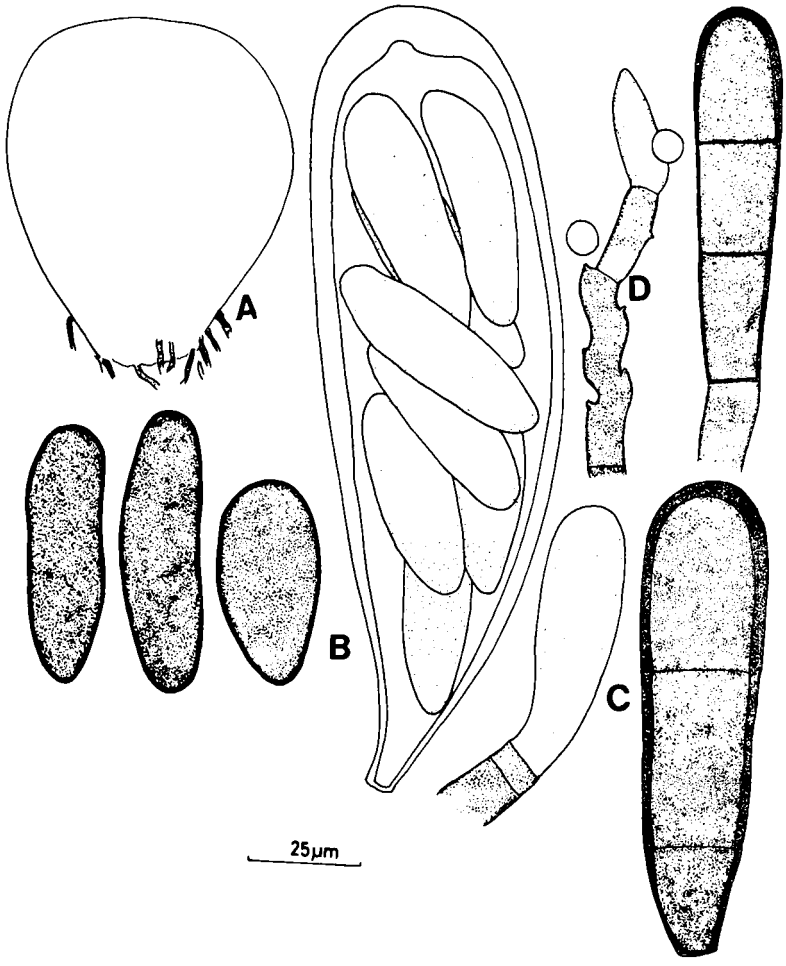


Fig. 50. *Pilgeriella perisporioides* (type). A, pseudothecium; B, ascus and ascospores; C, conidiophore and conidia of *Septoidium* state; D, conidiophore and microconidia.

Ascospores 45-60 × 18-28 µm, *Septoidium* conidia 90-110 × 26-30 µm..... ..... *P. perisporioides*

P. anacardii (Bat., Bezerra, Cast. & Matta) v. Arx & E. Müller, *Stud. Mycol.* **9:** 50, 1975 (Fig. 49).

Perisporiopsella anacardii Bat., Bezerra, Castrillón & Matta, *Publ. Inst. Micol. Univ. Recife* **431:** 4, 1964.

Anamorph: *Septoidium glaziovii* (Allescher) S. Hughes & Piroz., *Can. J. Bot.* **50:** 2531, 1972.

Dicoccum glaziovii Allescher in Henn., *Hedwigia* **36:** 244, 1897.
Diplodium anacardii Hansf., *Sydowia* **9:** 88, 1955.
Diploidium anacardiacearum Bat. & Cavalcanti in Bat., Cavalc. & Albuquerque, *Atas Inst. Micol. Univ. Pernamb.* **5:** 177, 1967.

Pseudothecia up to 220 μm broad. Asci sessile, 80-92 × 33-37 μm. Ascospores ellipsoidal to clavate, hyaline to brown, 35-52 × 16-22 μm.

Septoidium conidia oblong clavate, one septate, dark brown, smooth to irregularly roughened, 27-40 × 16-22 μm, with a truncate base. Microconidial state not seen.

On leaves of *Anacardium occidentale*. Brazil.

P. perisporioides Henn., *Hedwigia* **39:** (137), 1900 (Fig. 50).

Anamorphs: *Septoidium* sp. and a microconidial state.

Pseudothecia up to 300 μm broad. Asci clavate, 100-200 × 40-60 μm. Ascospores broadly oblong to ellipsoidal, hyaline to pale brown, 45-60 × 18-28 μm with a thick epispore.

Septoidium conidia 1-2 septate, clavate, 90-110 × 26-30 μm, with a truncate base. Microconidia 6-8 μm diam.

On leaves of *Loranthus* spp. Brazil.

CHAETOTHYRIALES

Pseudothecia immersed, erumpent or superficial, parasitic, hyperparasitic, epiphytic, saprobic or hypersaprobic, lens-shaped, depressed globose, globose, depressed or papillate. Asci interspersed with pseudoparaphyses, sometimes with apical and or lateral pseudoperiphysoids. Peridium composed of one or few layers. Ascospores usually asymmetric.

Families of Chaetothyriales (after Barr, 1979).

Ascocarps lens-shaped, parasitic or hyperparasitic; peridium composed of one layer of cells arranged in radiating rows; ascospores hyaline; conidial states hyphomycetous, dictyospores or staurospores borne on nonspecific conidiogenous cells..... Trichothyriaceae

Ascocarps globose, depressed or papillate, epiphytic, saprobic or hypersaprobic; peridium composed of few layers of cells not arranged in radiating rows..... 1

1. Ascocarps depressed globose beneath pellicle of pallid hyphae, setose in some taxa; ascospores hyaline or pale brownish; conidial states not known..... ..... Chaetothyriaceae

   Ascocarps globose, depressed or papillate, seated on/in sparse or well-developed subiculum..... 2

2. Subiculum well-developed, of moniliform hyphae that taper to ends, cells short and broad, constricted at septa; ascospores yellowish or brown; conidial states polymorphic; phialidic, blastic sympodioconidial of two kinds, and thallic..... Metacapnodiaceae

   Subiculum sparse, of more or less cylindric hyphae, not moniliform..... 3

3. Ascospores hyaline or yellowish or light brown, conidial states phialidic where known..... Naetrocymbaceae

   Ascospores pallid greyish, greenish, olivaceous brown or blackish..... ..... Herpotrichiellaceae

Herpotrichiellaceae Munk

Pseudothecia globose, conic or depressed, erumpent to superficial on a thin subiculum, often setose, usually with apical and/or lateral pseudoperiphysoids. Asci oblong to saccate, usually fasciculate eight or more spored. Ascospores pale grey, greenish, olivaceous brown to dark brown, transversely multiseptate or dictyoseptate. Saprobic, often hypersaprobic on old fungi or on dead wood or herbaceous stems and leaves.

Only one species of *Dictyotrichiella* is known to have an anamorph. Anamorphs are not known for other genera of this family.

DICTYOTRICHIELLA Munk, *Dansk Bot. Arkiv* **15:** 132, 1953.

Type sp.: *D. pulcherrima* Munk, *Dansk. Bot. Arkiv* **15:** 132, 1953.

Only one species known with *Exophiala* anamorph and this is only known in culture. It is with some doubt that this species is included in this genus.

D. mansonii Schol-Schwarz, *Antonie von Leeuwenhoek* **34:** 122, 1968 (Fig. 51).

Anamorph: *Exophiala mansonii* (Castell.) de Hoog, *Stud. Mycol.* **15:** 114, 1977.
Rhinocladiella mansonii (Castell.) Schol-Schwarz, *Antonie van Leeuwenhoek* **34:** 122, 1968. For other synonyms of the anamorph refer to de Hoog (1977).

Pseudothecia globose to subglobose, upto 100 μm broad, ostiolate, covered with dark brown, thick-walled, septate setae measuring 37-120 × 3-8 μm with a swollen base. Asci subcylindrical to clavate, 8 spored, thick-walled, 40-45 × 11-13 μm. Ascospores overlapping biseriate, ovoid, dark olivaceous, dictyoseptate, with 4-5 transverse septa and one vertical septum. Pseudothecia produced in culture from one of the strains of the anamorph.

Conidial colonies smooth to flat floccose, slimy at the centre or the whole colony slimy, greyish black to olivaceous black with an entire smooth or lobed margin. Budding cells numerous, thin-walled, subhyaline, broadly ellipsoidal, 3.8-6 × 2-4.3 μm. Germinating cells inflated in short chains. Central part of the mycelium torulose with short series of swollen cells with unswollen cells in the remaining part.

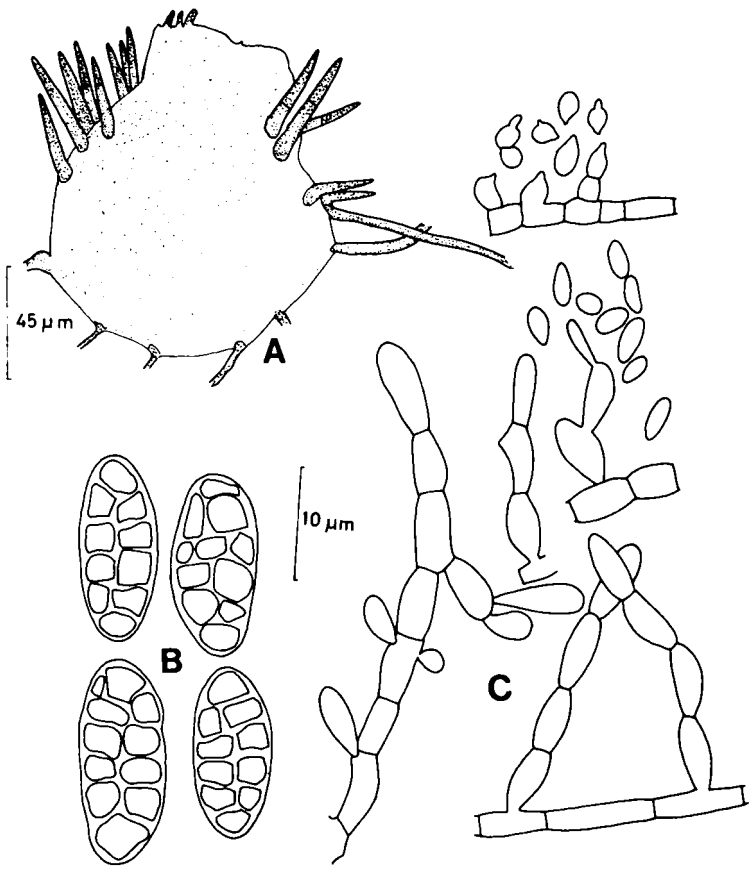


Fig. 51. *Dictyotrichiella mansonii* (type). A, pseudothecium; B, ascospores; C, conidiophores and conidia.

Submerged hyphae smooth, thin-walled. Conidiogenous cells on torulose mycelium, intercalary sometimes lateral, strongly swollen but not swollen on other hyphae. Each fertile cell with 2-3 annellations having a collarette-like appearance. Conidia hyaline, smooth, thin-walled, ellipsoidal to short cylindric, with inconspicuous basal scars, 2.9-4.7 × 1.8-2.6 µm. Hyphae and budding cells in old cultures become thick-walled, septate and moderately pigmented, sometimes small sclerotial bodies are formed.

Isolated from *Populus tremula*. Norway.

Metacapnodiaceae Hughes & Corlett

Hyphae superficial, brown to dark brown, usually wide, more or less tapering moniliform, smooth or roughened throughout or distally roughened, constricted at the septa, composed of cells generally broader than long, forming a well-developed subiculum or sparse network. Pseudothecia seated on or in the subiculum. Ascospores yellow-brown to brown, three or more septate or dictyoseptate, not mucronate at the ends.

Anamorphs: *Capnophialophora* (phialidic), *Capnobotrys* or *Capnocybe* (blastic sympodial), *Hormiokrypsis* or *Capnosporium* (poroconidial), ? *Torulopsiella* (arthroconidial), according to Hughes (1972).

Corlett (1970) and Corlett, Hughes & Kaufert (1973) have shown that the pseudothecial development in three species of *Metacapnodium* and two species of *Ophiocapnocoma* is of the *Pleospora*-type. The genetic connection between the teleomorph and the anamorph or anamorphs has not been established in culture but is strongly evident by the common kind of mycelia on which they are borne and by close association.

Key to genera of Metacapnodiaceae

Ascospores up to 11 septate, anamorphs *Capnophialophora, Capnobotrys* or *Capnocybe, Hormiokrypsis* or *Capnosporium, ?Torulopsiella*..... ..... *Metacapnodium*

Ascospores more than 11 septate, anamorphs *Capnophialophora* and *Hormiokrypsis*..... *Ophiocapnocoma*

METACAPNODIUM Speg., *Physis* **4:** 288, 1918.

Type sp.: *M. juniperi* (Phill. & Plowr.) Speg., *Physis* **4:** 288, 1918.

Anamorphs: Phialidic state: *Capnophialophora* S. Hughes (1966); others if produced: Blastic sympodioconidial state, *Capnobotrys* S. Hughes (1970) or *Capnocybe* S. Hughes (1966); Poroconidial state, *Hormiokrypsis* Bat. & Nascimento (1957) or *Capnosporium* S. Hughes (1976); Arthroconidial state, *Torulopsiella?*. (After Hughes, 1972).

About six species known. (Hughes, 1972, 1976, 1981).

Subiculum spongy, brown or rusty brown, dark brown to black, sometimes lobed or in the form of hemispherical lumps. Mycelium superficial, composed of pale to dark brown, moniliform, anastomosing, straight or curved hyphae which characteristically taper towards

the apex, septate, smooth or coarsely roughened, branched with branches more or less at right angles and curving upwards, composed of cells generally broader than long. Pseudothecia crowded, dark brown to black, basally immersed in the subiculum, with a basal pseudoparenchymatic cushion, bearing many septate, tapering, hyphal appendages. The pseudothecial wall is composed of dark brown, thick-walled cells on the outside and thin-walled, subhyaline cells towards the inside. Asci more or less ellipsoidal, 8 spored. Ascospores pale to dark brown, three or more septate, sometimes dictyoseptate, occasionally slightly constricted at the septa, end cells conical.

Capnophialophora: Phialides develop on hyphae, on ascostroma initials, on ascospores or on germ tubes arising from these, either singly or in two's, pale brown to dark brown, more or less subspherical, with one or rarely two subhyaline to pale brown, ellipsoidal to cylindrical, tapered or slightly flared, collarette. Phialides have a globose venter with a well-developed neck, occur singly or in irregular botryose clusters generally on the apex of the hyphal branches. Phialoconidia hyaline, broadly ellipsoidal to subglobose, one-celled.

Capnocybe: Synnemata erect, scattered or crowded, more or less conical and spongy at the base, cylindrical or tapering toward the apex which bears a head of conidia. Upper synnematous hyphae closely compacted, bearing toward the apex unilateral and randomly arranged primary, secondary and occasionally tertiary branches which terminate in single or successive ellipsoidal sympodulae. Sympodioconidia blastic, ellipsoidal, straight or slightly curved, dark brown, three or more septate, usually with rounded ends, smooth, thick-walled, sometimes formed in a black, shiny, gelatinous head. Conidiophores cylindrical or subulate synnemata whose tapering end cells of divergent hyphae are conidiogenous.

Capnobotrys: Conidiogenous cells terminal, subterminal, unilateral or in whorled groups, more or less globose, formed on upright branches. Sympodioconidia produced in succession at the apex of the conidiogenous cells, blastic, 1-many septate, coarsely roughened or smooth, dry, ellipsoid, straight or curved, oblong, sometimes secede easily leaving a small scar.

Capnosporium: In some species which produce a *Capnobotrys* state, a *Capnosporium* poroconidial state may also be formed. Conidiophores mostly erect bearing a single poroconidium at the apex and sometimes one on the penultimate cell. Conidia 2-4 septate, straight or distinctly curved with one central cell enlarged, ellipsoidal, obclavate to ovoid, pale brown to brown with a rounded base.

Key to Metacapnodium species with anamorphs

Ascospores 3 septate..... 1

Ascospores more than 3 septate..... 6

1. Anamorph *Capnophialophora* state only, ascospores 20-27 × 8-12 μm..... *M. juniperi*

   Anamorphs *Capnophialophora* and *Capnobotrys*..... 2

   Anamorphs *Capnophialophora, Capnobotrys* and *Capnosporium*..... 5

   Anamorphs *Capnophialophora* and *Capnocybe,* ascospores 25-40 × 10-13.5 μm..... *M. spongiosum*

2. Ascospores up to 27 μm long..... 3

   Ascospores up to 38 μm long..... 4

3. Ascospores 18-27 × 8.6-12 μm, with paler thinner-walled areas..... *M. crassum*

   Ascospores 20-27 × 9-11 μm without paler thinner-walled areas..... *M. dingleyae*

4. Ascospores 27-38 × 11-14.5 μm..... *M. dennisii*

   Ascospores 23.5-34 × 10.8-14.4 μm..... *M. smilacinum*

5. Ascospores 15.8-19.4 × 8.6-9.7 μm..... *M. guava*

   Ascospores 18-38.5 × 9-13 μm..... *M. moniliforme*

6. Ascospores 5 septate, 32-50 × 9.5-13 μm, anamorphs *Capnophialophora* and *Capnobotrys*..... *M. quinqueseptatum*

   Ascospores 5-11 septate, 30-103 × 9-13.5 μm, anamorphs *Capnocybe* and *Capnophialophora*..... *M. fraserae*

M. crassum (Pat.) S. Hughes, *N.Z. Jl Bot.* **19:** 205, 1981.

Capnodium crassum Pat. in Pat. & Lagerheim, *Bull. Soc. mycol. Fr.* **11:** 223, 1895.
Limacinia crassa (Pat.) Sacc. in Sacc. & Lindau, *Hedwigia* **36**(7): XX, 1897.
Phragmocapnias crassa (Pat.) Cif. & Bat. in Bat. & Cif., *Saccardoa* **2:** 179, 1963.

Anamorphs: *Capnophialophora* sp. and *Capnobotrys* sp.

Ascospores ellipsoidal to somewhat clavate with tapered ends, 3 septate, 18-27 × 8.6-12 μm, with paler thinner-walled areas. *Capnophialophora* phialides scanty with phialides constricted at the base of the collarette. *Capnobotrys* conidia not cornuate, somewhat similar to *M. guava,* 10.8-14.4 × 8.6-10 μm.

On indet. Melastomataceae. Ecuador.

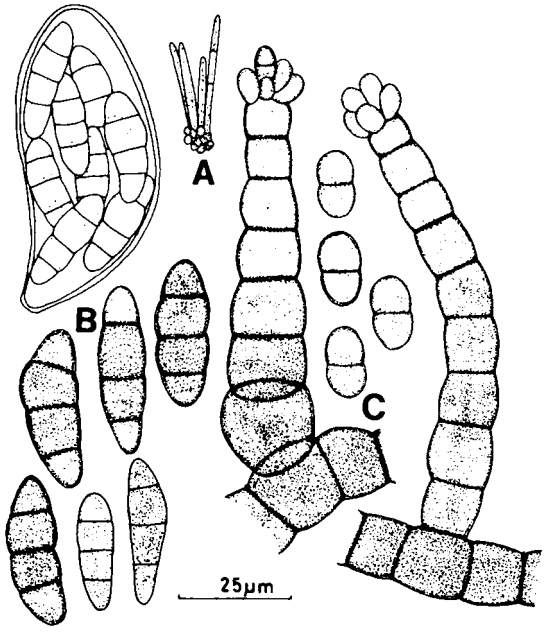


Fig. 52. *Metacapnodium dennisii* (type). A, setae; B, ascus and ascospores; C, *Capnobotrys* conidiophores and conidia.

M. dennisii S. Hughes, *Kew Bull.* **31:** 573, 1976 (Fig. 52).

Anamorphs: *Capnophialophora* sp. and *Capnobotrys* sp.

Pseudothecia up to 125 µm broad with hyphal appendages and bearing *Capnobotrys* fructifications. Asci 50-80 × 40-45 µm, 8 spored. Ascospores broadly ellipsoidal, 3 septate, slightly constricted at the septum, brown to olivaceous brown, paler at the ends, 27-38 × 11-14.5 µm.

Capnophialophora phialides 7.2-9 × 5.4-7.2 µm. Phialoconidia scanty, broadly ellipsoidal, hyaline, up to 1 µm broad. *Capnobotrys* fructifications developing at the ends of erect hyphae stalked or sessile. Conidia dry, clustered, seceding easily, pale to dark brown, smooth, septate in the middle or submedianly, slightly constricted at the septum when mature, 16-21.6 × 9-12.6 µm.

On living leaves of *Durio zibethinus, Psidium guajava* and *Hevea brasiliensis*. Malaysia.

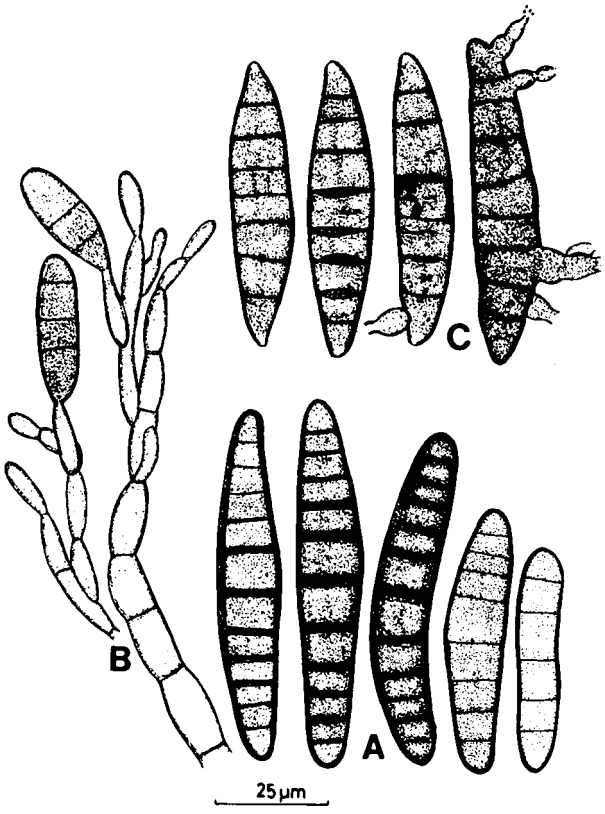


Fig. 53. *Metacapnodium fraserae*. A, ascospores; B, *Capnocybe* conidiophores; C, *Capnocybe* conidia.

M. dingleyae S. Hughes, *N.Z.Jl Bot.* **19:** 213, 1981.

Anamorphs: *Capnobotrys dingleyae* S. Hughes and *Capnophialophora* sp. (*Mycotaxon* **1:** 121, 1974).

Pseudothecia partly immersed, up to 185 µm broad. Asci 57-72 × 18-22 µm. Ascospores ellipsoidal, to inequilateral, brown to dark brown, 3 septate, scarcely constricted at the septa, 20-25(27) × 9-11 µm.

Capnobotrys conidiogenous cells hemispherical to doliiform, up to 14.5 µm long, 12.5 µm wide with scars on denticles after liberation. Conidia ovoid to obclavate, 0-6 septate, usually 2 septate, thick-walled, pale to dark brown, variable, 10.5-50 × 8.6-13 µm.

Capnophialophora phialides in groups of 2-4 on the end cells of hyphae

or single on *Capnobotrys* conidia, up to 5.5 μm wide. Phialoconidia hyaline, rare, ellipsoid, 1.5 × 1 μm.

On decorticated trunks and exposed wood of Gymnosperms (*Dacrydium, Phyllocladus, Podocarpus* and *Taxus*). Great Britain and New Zealand.

M. fraserae (S. Hughes) S. Hughes, *Mycologia* **68:** 782, 1976 (Fig. 53).

Limacinia fraserae S. Hughes, *N.Z.Jl Bot.* **4:** 352, 1966.

Anamorphs: *Capnophialophora fraserae* S. Hughes, *N.Z.Jl Bot.* **4:** 352, 1966 and *Capnocybe fraserae* S. Hughes, *N.Z.Jl Bot.* **4:** 336, 1966.

Pseudothecia up to 300 μm broad, bearing moniliform, finally roughened appendages. Asci 3-8 spored, 120-140 × 30-41 μm. Ascospores ellipsoidal, wider just above the middle, paler at the ends, 5-11 septate, very variable in size, 30-103 × 9-13.5 μm.

Capnophialophora phialides scanty on mycelial hyphae, frequent on conidia and on short germinal hyphae, sometimes in botryose clusters, 5.7-9.3 × 3.5-4.5 μm; collarettes 4.5-6.5 × 3.5-4.3 μm. Phialoconidia broadly ellipsoidal to subglobose, hyaline, 1.3-1.4 × 1 μm. *Capnocybe* synnemata up to 4 mm high with columnar region up to 700 μm wide terminating in a head of conidia up to 800 μm wide. The terminal cells function as sympodulae, 11-18 × 5-7.2 μm, and bear at maturity up to four denticulate conidial scars round the apex. Sympodioconidia ellipsoidal, 4-13 (usually 8), septate, smooth, dark brown, thick-walled, rounded at the ends, 40-130 × 12-18 μm, with an inconspicuous basal scar.

On a wide variety of dicotyledonous hosts. Juan Fernandes Islands, New Zealand, U.S.A.(Hawaii).

M. guava (Cooke) S. Hughes, *N.Z. Jl Bot.* **19:** 204, 1981.

Antennaria guava Cooke in Vize, *Grevillea* **5:** 110, 1877.

Anamorphs: *Capnobotrys* sp., *Capnophialophora* sp. and *Capnosporium* sp.

Ascospores 3 septate, 15.8-19.4 × 8.6-9.7 μm. *Capnophialophora* phialides are of the *M. moniliforme* kind with a deep constriction where the collarette joins the venter, formed on hyphae connecting the pseudothecia and also on germinated conidia of *Capnobotrys* and *Capnosporium*.

Capnosporium conidia abundant, 2-3(4) septate, 14-32.5 × 7-11.7 μm.

Capnobotrys conidia not cornuate and not very enlarged, 8.8-13.5 × 6.1-8.2 μm.

On leaves of *Psidium guajava*. U.S.A.

M. juniperi (Phill. & Plowr.) Speg., *Physis* **4:** 288, 1918 (Fig. 54).

Capnodium juniperi Phill. & Plowr., *Grevillea* **13:** 75, 1885.
Leptocapnodium juniperi (Phill. & Plowr.) Bat. & Cif., *Saccardoa* **2:** 112, 1963.
Polychaeton juniperi (Phill. & Plowr.) Kuntze, *Rev. Gen. Pl.* **1:** 13, 1891.

Anamorph: *Capnophialophora* sp.

Pseudothecia up to 220 μm broad with numerous hyphal appendages. Asci 65-80 × 23-27 μm. Ascospores 3 septate, 20-27 × 8-12 μm, with somewhat conical end cells.

Capnophialophora phialides 4.5-5.5 μm broad. Phialoconidia broadly ellipsoidal to subglobose, hyaline, about 1 μm wide.
Sympodioconidia, poroconidia and arthroconidia not observed.

On twigs of *Juniperus communis*. Scotland.

M. moniliforme (Fraser) S. Hughes, *Mycologia* **68:** 709, 1976 (Fig. 55).

Capnodium moniliforme Fraser, *Proc. Linn. Soc. N.S.W.* **60:** 168, 1935.
Limacinia moniliformis (Fraser) Barr, *Can. J. Bot.* **33:** 505, 1955.

Anamorphs: *Capnophialophora* sp., *Capnobotrys* sp. and *Capnosporium* sp.

Pseudothecia up to 205 μm broad with short, stiff, hyphal appendages around the apex. Asci 64-112 × 15-27 μm. Ascospores ellipsoid-fusoid, often inequilateral or slightly curved, 3 septate, 18-38.5 × 9-13 μm, with rounded ends.

Capnophialophora phialides up to 5 μm broad. Phialoconidia hyaline, broadly ellipsoidal about 1 μm wide.

Capnobotrys conidia broadly ellipsoidal, septate in the middle, markedly cornuate, hyaline to dark brown, thick-walled, smooth to verruculose, 10-20 × 7-10 μm.

Capnosporium conidia formed singly at the apex and sometimes on the penultimate cell of the erect conidiophore. Conidia 3 septate, cylindrical to obovoid, straight to curved, with enlarged central cells.

On *Arctostaphylos, Alyxia, Backhousia, Callistemon, Cryptocarya, Doryphora, Epacris, Eugenia, Ficus, Podocarpus, Polystichum, Tristania* and *Weinmannia*. Australia and U.S.A.

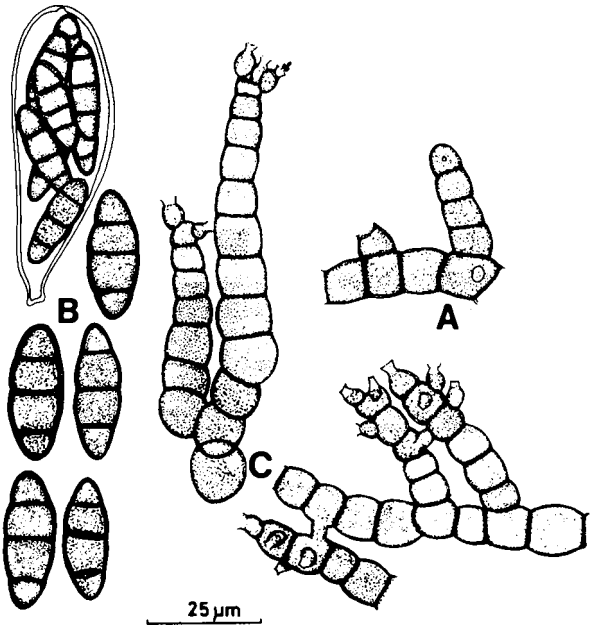


Fig. 54. *Metacapnodium juniperi* (type). A, hyphae; B, ascus and ascospores; C, *Capnophialophora* state.

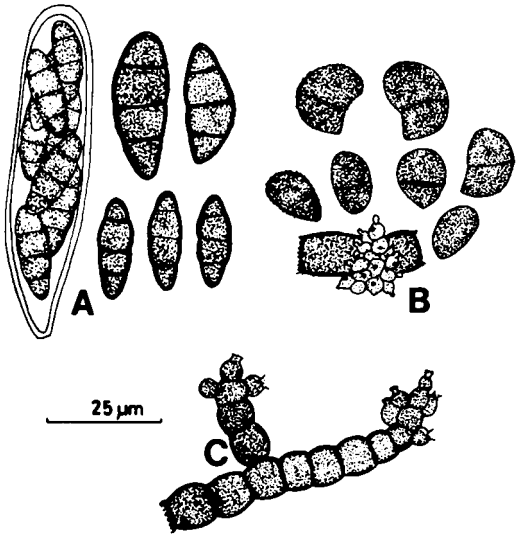


Fig. 55. *Metacapnodium moniliforme.* A, ascus and ascospores; B, *Capnobotrys* conidiophores and conidia; C, *Capnophialophora* state.

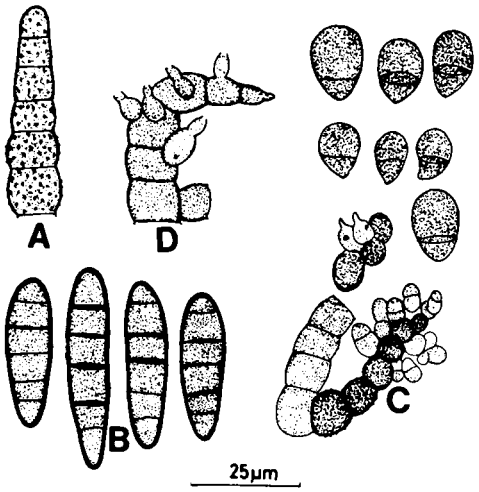


Fig. 56. *Metacapnodium quinqueseptatum* (type). A, hyphae; B, ascospores; C, *Capnobotrys* conidiophore and conidia; D, *Capnophialophora* state.

M. quinqueseptatum (Barr) S. Hughes, *N.Z.Jl Bot.* **10:** 233, 1972. (Fig. 56).

Limacinia moniliformis (Fraser) Barr var. *quinqueseptata* Barr, *Can. J. Bot.* **33:** 507, 1955.
Limacinia quinqueseptata (Barr) S. Hughes, *N.Z.Jl Bot.* **4:** 344, 1966.

Anamorphs: *Capnophialophora* sp. and *Capnobotrys* sp.

Pseudothecia up to 205 µm broad. Asci 80-96 × 25-40 µm. Ascospores 5 septate, slightly curved, 32-50 × 9.5-13 µm.

Capnophialophora phialides up to 5.5 µm broad. Conidia about 1 µm broad.

Capnobotrys conidia smooth to verruculose, finally brown, 1 septate, obovoid, narrowed toward the base, 10-16 × 9-12 µm.

On branches of *Arctostaphylos sensitiva* and *Arctostaphylos* spp. U.S.A.

M. smilacinum (Mendoza) S. Hughes, *N.Z.Jl Bot.* **19:** 208, 1981.

Phragmocapnias smilacina Mendoza in F. Stev., *Bull. Bernice P. Bishop Mus.* **19:** 58, 1925.

Anamorphs: *Capnophialophora* sp. and *Capnobotrys* sp.

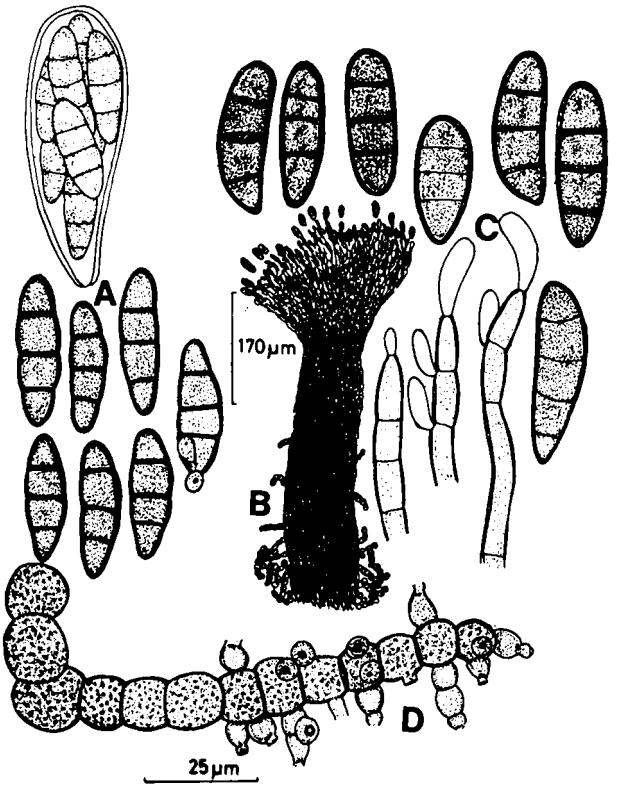


Fig. 57. *Metacapnodium spongiosum.* A, ascus and ascospores; B, *Capnocybe* synnemata; C, *Capnocybe* conidia; D, *Capnophialophora* state.

Ascospores inequilateral, 3 septate, 23.5-34 × 10.8-14.4 µm, terminal cells with lateral or subapical paler and thinner-walled area on the flattened side. Germinated ascospores 27-40 × 12.6-16.2 µm.

Capnophialophora phialides more or less cylindrical and not constricted where they join the venter.

Capnobotrys conidia 2-3 septate, cornuate, 16.2-23.4 × 12.5-18 µm.

On *Smilax* and *Pelea*. U.S.A(Hawaii).

M. spongiosum S. Hughes & Sivan. sp. nov. (Fig. 57).

Anamorphs: *Capnocybe spongiosa* (Hoerl.) S. Hughes, *N.Z.Jl Bot.* **4:** 349, 1966 (= *Arthrobotryum spongiosum* Hoerl., *Madrono* **5:** 75, 1939) and *Capnophialophora* sp.

Pseudothecia superficialia, ad basim immersa, brunnea vel atra, late ovoidea, 135-210 μm diam., 90-160 μm lata, ad maturitatum ostiolata, hyphis simplicibus vel aliquando ramosis, grosse asperrimis, moniliformibus, subatis, ad 50 μm longa ornatis. Asci ellipsoidei vel obclavati, bitunicati, octospori. Ascosporae irregulariter multiseriatae, ellipsoideae, ad septa non vel paulo constrictas, pallide brunneae vel atrobrunneae, crassitunicatae, 3 septatae, laeves, plerumque rectae, 25-40 × 10-13.5 μm.

In ramis *Juniperi* spp., Serra da Arrabida, Portugal, 25.x.1955, R.W.G. Dennis in herb. *K*, holotypus.

Pseudothecia superficial or basally immersed, brown to black, broadly ovoid, 135-210 μm high, 90-160 μm wide, ostiolate at maturity, bearing crowded or scattered, simple or occasionally branched, coarsely roughened, moniliform, tapering hairs up to 50 μm long. Asci ellipsoidal to obclavate, 8 spored. Ascospores irregularly multiseriate, ellipsoidal, not or slightly constricted at the septa, pale brown to dark brown, thick-walled, 3 septate, smooth, usually straight, very variable in size, 25-40 × 10-13.5 μm. Ascospores have been seen bearing one or two *Capnophialophora* phialides similar to those produced on the subiculum of *Capnocybe spongiosa*.

Capnophialophora phialides up to 5.5 μm broad. Phialoconidia minute. *Capnocybe* conidia 1-5 (mostly 3) septate, sometimes constricted at the septa, 23-47 × 10.5-15 μm, with an inconspicuous basal scar.

Other collections on *Chamaecyparis, Cupressus, Libocedrus* and *Pinus*. Corsica and U.S.A.

OPHIOCAPNOCOMA Bat. & Cif., *Saccardoa* **2:** 168, 1963.

Type sp.: *O. phloiophilia* (Fisher) S. Hughes, *N.Z.Jl. Bot.* **5:** 120, 1967.

Anamorphs: *Capnophialophora* S. Hughes (1966) and *Hormiokrypsis* Bat. & Nascimento (1957).

Subiculum spongy, dark brown to black, effuse or with an irregular lumpy surface or forming large rounded cushions. Superficial mycelium composed of anastomosing, branched, septate, strongly constricted, brown to dark brown hyphae tapering towards their distal ends. Hyphae straight or bent or geniculate at the point of branching, most part smooth with their ends slightly roughened. Pseudothecia superficial or immersed, dark brown to black, scattered or grouped together, subglobose, ostiolate at maturity, bearing simple or rarely branched, moniliform hyphal appendages which are septate, roughened, tapering and sometimes anastomosing with the vegetative hyphae. The pseudothecial wall is made up of an inner layer of compressed cells which merge

gradually with the outer layer of more deeply pigmented pseudoparenchymatic cells. Asci fasciculate, ellipsoidal or obclavate, 2-8 spored. Ascospores subcylindrical with narrowly ellipsoidal to fusiform tapering rounded ends, yellowish brown to dark brown, straight or curved, usually wider in the middle, thick-walled, multiseptate, with rarely a vertical septum in one or two cells.

Capnophialophora: Phialides develop on vegetative hyphae, on ascospores or on porospores, singly or in clusters, directly or on germinant hyphae arising from these structures. They are usually subspherical with a flattened base, pale brown to dark brown, slightly roughened with one or rarely two terminal, more or less cylindrical or slightly basally broader, pale brown to dark brown collarettes which open finally with an irregular pore. Phialospores broadly ellipsoidal to subglobose, hyaline.

Hormiokrypsis: Conidiophores more robust and darker than the vegetative hyphae with the apical cell very thickened especially around the apex and with a conspicuous pore adjacent to that in the basal cell of the porospore which it supports. Poroconidia variable in size and shape, generally staurosporic at maturity, brown to very dark brown, sometimes paler and usually roughened toward the apex, septate, constricted at the septa, composed of an obovoid to obclavate, septate central axis with a large, rounded basal cell, and the cell above this bears usually two downwardly directed septate tapering arms. Porospores frequently anastomose with conidiophores that bear them, with vegetative hyphae or with other porospores or may produce other smaller porospores or *Capnophialophora* phialides.

The teleomorphs and anamorphs arise from a common mycelium and their genetic connection is not in doubt.

Only two species known (Hughes, 1967a).

Key to Ophiocapnocoma species

Ascospores up to 22 septate, 36-190 × 7-15 μm, with both *Capnophialophora* and *Hormiokrypsis* anamorphs..... *O. phloiophilia*

Ascospores up to 20 septate, 47-167 × 16-24(38) μm, with only *Capnophialophora* anamorph..... *O. batistae*

O. batistae S. Hughes, *N.Z.Jl. Bot.* **5**: 128, 1967 (Fig. 58).

Anamorph: *Capnophialophora* sp.

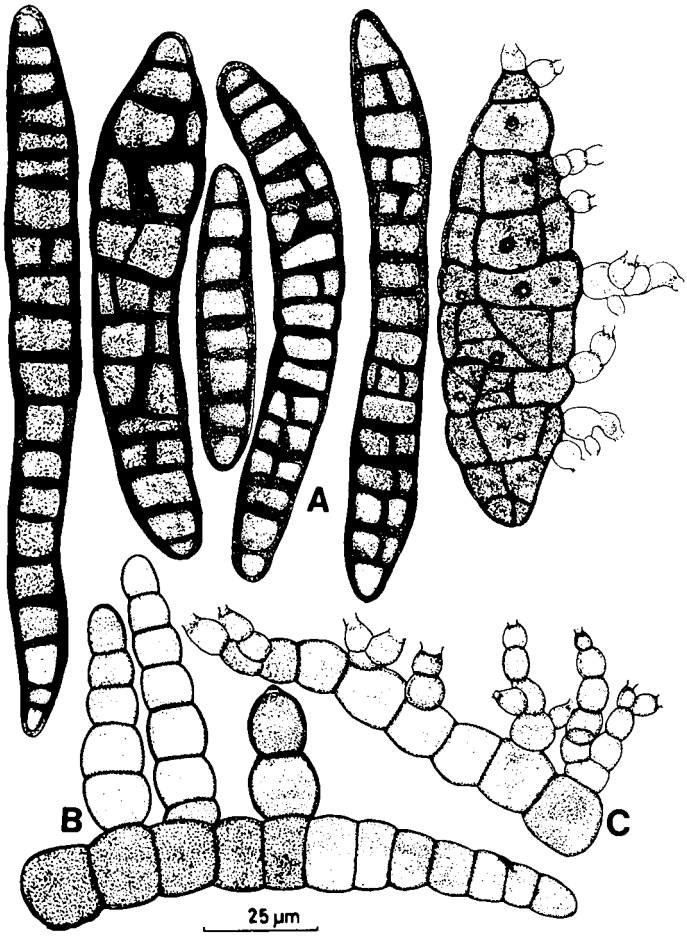


Fig. 58. *Ophiocapnocoma batistae*. A, ascospores; B, hyphae; C, *Capnophialophora* state.

Pseudothecia up to 400 µm broad. Asci 120-200 × 30-63 µm. Ascospores subcylindrical to ellipsoid, 6-20 septate, not or slightly constricted at the septa, with a vertical septum in one or two cells, 47-167 × 16-24 (38) µm. *Capnophialophora* phialides single or botryose, asperate, 7-7.5 × 7 µm. Collarettes 3.5-5 × 3.5 µm. Phialospores broadly ellipsoidal, hyaline, about 1.5 µm long. Phialides occasionally proliferate to produce a second phialide.

On trunks of *Nothofagus solandri* var. *cliffortioides,* New Zealand.

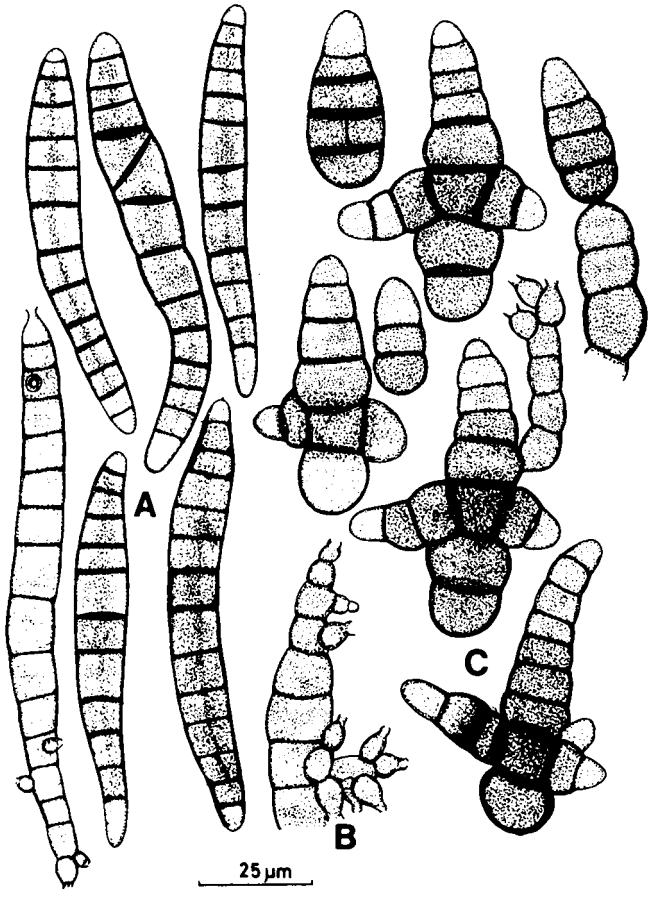


Fig. 59. *Ophiocapnocoma phloiophilia.* A, ascospores; B, *Capnophialophora* state; C, *Hormiokrypsis* conidia.

O. phloiophilia (Fisher) S. Hughes, *N.Z. Jl Bot.* **5:** 120, 1967 (Fig. 59).

Limacinia phloiophilia Fisher, *Proc. Roy. Soc. Vict.* (N.S.) **54:** 1, 1942.
Limacinia multiseptata Barr, *Can. J. Bot.* **33:** 507, 1955.
Ophiocapnocoma multiseptata (Barr.) Bat. & Cif., *Saccardoa* **2:** 168, 1963.

Anamorphs: *Hormiokrypsis libocedri* Bat. & Nascimento, *An. Soc. Biol. Pernamb.* **15:** 345, 1957 and *Capnophialophora* sp.

Pseudothecia up to 275 µm broad. Asci 120-200 × 27-45 µm. Ascospores narrowly ellipsoidal to fusiform, up to 22 septate, sometimes

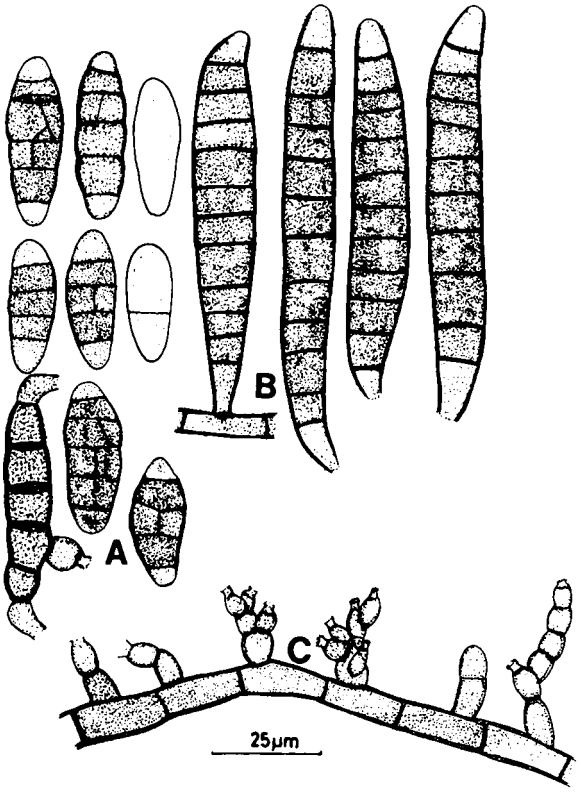


Fig. 60. *Strigopodia batistae.* A, ascospores; B, *Antennatula* conidia; C, *Capnophialophora* state.

with a vertical septum in one or two of the wider cells, very variable in size, 36-190 × 7-15 µm.

Capnophialophora phialides 6-7 × 6.5-7.5 µm. Collarettes 4.5-6.3 × 3.6-4.3 µm. Phialospores broadly ellipsoidal to subglobose, hyaline, 1.4 µm long and 1.3 µm wide.

Hormiokrypsis porospores with a central axis of 4-9 cells and up to 100 µm long.

On trunks of *Arctostaphylos, Coprosma, Eucalyptus, Kunzea, Leptospermum, Phyllocladus* and *Tristania.* Australia, New Zealand, U.S.A.

Naetrocymbaceae Höhnel

Subiculum sparse, composed of more or less cylindrical hyphae, not moniliform. Pseudothecia globose, depressed or papillate, superficial. Ascospores hyaline, yellowish or pale brown. Anamorphs phialidic when present.

Key to genera of Naetrocymbaceae with anamorphs

Ascospores transversely septate, anamorph *Microxiphium*..... *Dennisiella*

Ascospores dictyoseptate, anamorphs *Antennatula* and *Capnophialophora*.... ..... *Strigopodia*

DENNISIELLA Bat. & Cif., *Sydowia Beih.* **3:** 37, 1962.

Vitalia Cif. & Bat., in Bat. & Cif., *Sydowia Beih.* **3:** 105, 1962.

Type sp.: *D. babingtonii* (Berk.) Bat. & Cif., *Sydowia Beih.* **3:** 38, 1962.

Anamorph: *Microxiphium* state (Hughes, 1976).

Hyphae narrow, repent and closely adpressed to the substratum, forming a close network by the production of opposite and alternate branches which anastomose or it forms a hyphal plate. Setae non septate, dark brown to black, straight, curved or apically hooked, arising singly from a slightly thickened, more deeply pigmented cushion of cells and it is from the cells adjacent to the setae that the cortex of hyphae arises to constitute the *Microxiphium* state or they may lack a hyphal cortex. Ascomata cupulate, black, smooth or setose, non ostiolate, with or without hyphal cortex. The outer wall is composed of one, two or more layers of subglobose cells which are thin-walled and paler than the flattened cells towards the inside. The base of the ascostroma is composed of regular columns of cells derived from cells of the original plate and is flattened and adpressed to the surface of the substratum. Setae simple, continuous, usually straight, without a basal cushion of cells and hyphal cortex. Asci broadly cylindrical, 8 spored. Ascospores narrowly or broadly ellipsoidal, hyaline, 3-7 septate, straight or slightly curved.

Mature setae encircled by a cortex of hyphae bear terminal rosettes of subglobose, presumed phialides, which form an abundance of conidia in a mucilaginous head that shines when dry. Conidia are ovoid, hyaline, one-celled, minute.

The mycelial hyphae of this genus are similar to those of Chaeto-

thyriaceae but the ascomatal development is not *Chaetothyriaceous*. Batista & Ciferri (1962) included *Dennisiella* in the Phaeosaccardinulaceae because of pigmented hyphae. Hughes (1976) suggested that a new family has to be found to accommodate this genus along with *Limacinula,* perhaps the Naetrocymbaceae. Barr (1979) agreed with Hughes' suggestion and placed it in Naetrocymbaceae.

D. babingtonii (Berk.) Bat. & Cif., *Sydowia Beih.* **3:** 37, 1962.

Strigula babingtonii Berk., *J. Hort. Soc.* **4:** 24, 1849.
Zukalia setosa Woronichin, *Bull. Appl. Bot. Sel.* **8:** 788, 1915.
Chaetothyrium babingtonii (Berk.) Dennis & M.B. Ellis, *Trans. Br. mycol. Soc.* **35:** 199, 1952.
Chaetothyrium babingtonii (Berk.) Keissler in Rabenh. *Kryptogamenfl.* **9:** 446, 1937.
Dennisiella setosa (Woronichin) Bat. & Cif., *Sydowia Beih.* **3:** 39, 1962 (as '*setosicola*').

Anamorph: *Microxiphium fagi* (Pers.) S. Hughes, *Mycologia* **68:** 790, 1976.
Fumago fagi Pers., *Mycol. europ.* **1:** 10, 1822.

Ascomata up to 220 μm broad. Setae 80-120 × 6-8 μm, straight to slightly curved, arising from a basal cushion of cells. Asci 40-63 × 13-18 μm. Ascospores broadly fusoid, 3-6 septate, 14-23 × 5-7 μm.

Microxiphium phialides 3.5-5 μm in diam. Conidia 2-2.8 μm.

On *Arundinaria, Buxus, Camellia, Elaeagnus, Fagus, Ligustrum, Mercurialis, Pelargonium, Phyllyrea, Populus, Prunus, Psidium, Rhododendron* and *Yucca*. Cosmopolitan.

A full history and account of the species was given by Dennis & Ellis (1952) under the name *Chaetothyrium babingtonii*.

STRIGOPODIA Bat. in Bat., Maia & Vital, *An. Soc. Biol. Pernamb.* **15:** 440, 1957.

Type sp.: *S. resinae* (Sacc. & Bres.) S. Hughes, *Can. J. Bot.* **46:** 1100, 1968.

Anamorphs: *Antennatula* Fr. (*Hormisciella*) phragmoconidial and *Capnophialophora*. S. Hughes (phialidic).

Subiculum effuse, dense, woolly, superficial, dark olivaceous brown to black, resinicolous. Hyphae superficial erect, repent, cylindrical,

branched usually at right angles, pale to dark brown, finely to coarsely roughened, thick-walled, septate, not or slightly constricted at the septa, frequently anastomosing. Pseudothecia immersed in the subiculum, scattered or aggregated, black, subglobose, ostiolate at maturity, up to 200 μm broad with numerous simple hyphal appendages which may anastomose and continue to grow as ordinary hyphae. Asci fasciculate, broadly ellipsoidal, 8 spored. Ascospores usually irregularly many seriate in the ascus, ellipsoid to broadly ellipsoid, sometimes wider above, brown to dark brown, smooth, thick-walled except at the blunt rounded ends, transversely 3-7 septate with vertical septa in 1-4 cells.

Antennatula conidia developing singly along the hyphae as blown out projections of the lateral wall of a hyphal cell, sessile, narrowly ellipsoid to subcylindrical, straight, curved or more or less sigmoid, up to 18 septate, thick-walled, not constricted at the septa, smooth, pale brown to dark olivaceous brown, rounded at the slightly paler apex and somewhat flattened at the basal scar.

Capnophialophora phialides formed on hyphae, on germinating ascospores, rarely on conidia. Phialides sessile or terminal and lateral on 1-2 celled stalks, more or less ovoid or subspherical, pale brown, slightly roughened, bearing a single pale brown, funnel-shaped collarette with a wide open end at maturity. Phialoconidia sparse, hyaline, subspherical, one celled. Phialides frequently proliferate laterally just below a collarette to form another phialide which in turn may also proliferate in this sympodial manner.

Species are resinicolous and resemble sooty moulds in the dark subiculum. The phragmoconidia are like those of *Antennatula* but the phialides are of the *Capnophialophora* type and not of the *Hormisciomyces* type as in Euantennariaceae. The ascospores are not mucronate at their ends. In the phragmoconidial state and hyphae, *Strigopodia* is like members of the Euantennariaceae but in the phialidic state it is allied to the Metacapnodiaceae. In *S. resinae,* the pseudothecium is found to have a *Pleospora*-type of centrum (Corlett *et al.,* 1973). Hughes (1976) excluded *Strigopodia* from the Metacapnodiaceae because of the cylindrical and comparatively narrow hyphae and because its phragmoconidial state has no counterpart in the potential imperfect state compliment exhibited by that family.

Key to the species of Strigopodia

Primary septum of the ascospore median..... 1

Primary septum of the ascospore submedian..... 2

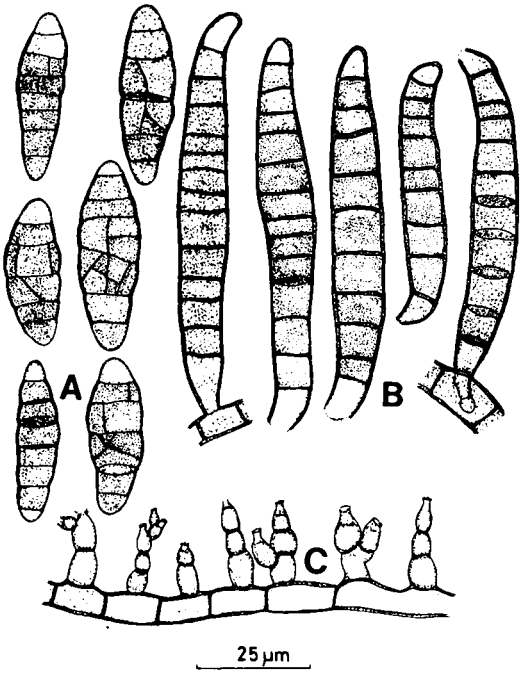


Fig. 61. *Strigopodia resinae*. A, ascospores; B, *Antennatula* conidia; C, *Capnophialophora* state.

1. Ascospores transversely 3-7 septate, 24-51 × 8-13 µm, phragmoconidia 9-18 septate, 74-160 × 13-17.5 µm..... *S. spongiosa.*

   Ascospores transversely 5-7 septate, 34-45 × 12.5-16 µm, phragmoconidia 9-11 septate, 72-118 × 10-14.5 µm..... *S. resinae*

2. Ascospores transversely 4-6 septate, 30.5-46.5 × 12.5-16.2 µm, phragmoconidia 8-12 septate, 75-117 × 12.6-17 µm..... *S. batistae*

S. batistae S. Hughes, *Can. J. Bot.* **46:** 1104, 1968 (Fig. 60).

Pseudothecia up to 200 µm broad. Asci 80-95 × 27-38 µm. Ascospores transversely 4-6 (mostly 4-5) septate, not or scarcely constricted at the septa, with 1-2 central cells vertically septate, 30.5-46.5 × 12.5-16.2 µm. Primary septum of the ascospore submedian formed in the lower half of the ascospore initial.

Antennatula conidia 8-12 septate (usually 9-11) septate, 75-117 × 12.6-17 µm. *Capnophialophora* phialides and phialospores are similar to that of *S. resinae*.

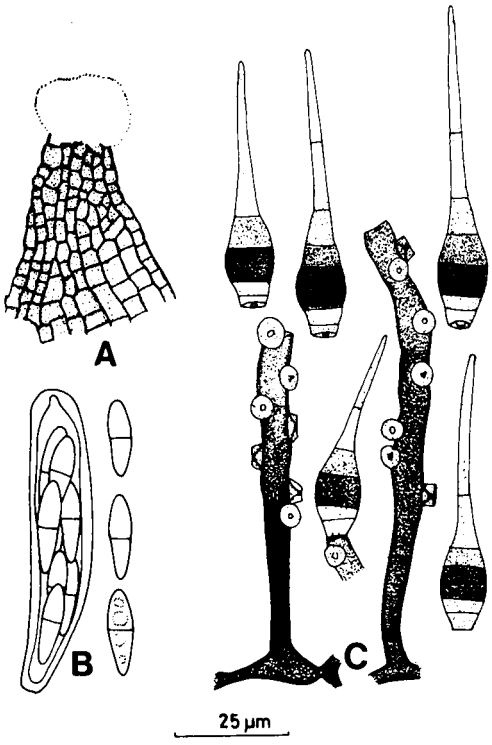


Fig. 62. *Trichothyrium asterolibertiae* (type). A, part of thyriothecium; B, ascus and ascospores; C, conidiophores and conidia.

On resin of *Pseudotsuga taxifolia* and *Larix occidentalis*. U.S.A.

S. resinae (Sacc. & Bres.) S. Hughes, *Can. J. Bot.* **46:** 1100, 1968 (Fig. 61).

Capnodium resinae Sacc. & Bresad. in Bresad. & Sacc., *Malpighia* **11:** 322, 1897 (as '*Capnodium (Limacinia) resinae*').
Limacinia resinae (Sacc. & Bresad.) Sacc. & Bresad., *Syll. Fung.* **14:** 475, 1899.
Strigopodia piceae Bat., in Bat., Maia & Vital, *An. Soc. Biol. Pernamb.* **15:** 440, 1957.
Phragmocapnias resinae (Sacc. & Bresad.) Bat. & Cif., *Saccardoa* **2:** 182, 1963.

Mycelial state: *Racodium resinae* Fr. *β piceum* Pers., *Mycol. Europ.* **1:** 68, 1822.

Anamorph: *Helminthosporium resinaceum* Cooke, *Grevillea* **17:** 68, 1889.

Helminthosporium resinae Bresad. in Bresad. & Sacc., *Malpighia* **11:** 322, 1897.
Sporhelminthium resinae (Bresad.) Speg., *Physis* **4:** 292, 1918.
Clasterosporium resinae Rilstone, *J. Bot. Lond.* **79:** 188, 1941.
Hyphosoma resinae (Cooke) S. Hughes, *Can. J. Bot.* **36:** 781, 1958.

Pseudothecia up to 200 μm broad. Asci 65-80 × 30-35 μm. Ascospores transversely 5-7 septate with 1-4 cells with 1 or 2 vertical septa, constricted at the septa, 34-45 × 12.5-16 μm. Primary septum of the ascospore, median.

Antennatula conidia 7-14 (usually 9-11) septate, 72-118 × 10-14.5 μm. *Capnophialophora* phialides 6.5-10.5 μm long, 5.4-6.3 μm wide, collarettes 4-5 μm wide, 3-3.5 μm deep. Phialospores sparse 1-1.5 μm wide.

On resin of *Abies, Larix, Picea* and other coniferous barks. Europe, Canada and U.S.A.

S. spongiosa (Barr) Barr, *Contr. Univ. Michigan Herb.* **9:** 622, 1972.

Capnodium spongiosum Barr, *Can. J. Bot.* **33:** 511, 1955.
Capnopheum spongiosum (Barr.) Bat. & Cif., *Saccardoa* **2:** 108, 1963.

Pseudothecia up to 340 μm broad. Asci 64-100 × 22.4-40 μm. Ascospores 3-7 septate with one vertical septum in 1-2 central cells, not or constricted at the septum, 24-51 × 8-13 μm. Primary septum median.

Antennatula conidia 9-18 septate, 74-160 × 13-17.5 μm. *Capnophialophora* state similar to *S. resinae.*

On resinous bark of *Chamaecyparis, Cupressus, Libocedrus* and *Pseudotsuga.* U.S.A.

Trichothyriaceae Theiss.

Pseudothecia lenticular, immersed erumpent or superficial. Peridium of one layer composed of radially arranged rows of cells with the upper and lower plates fused at the periphery. Parasites or hyperparasites on other fungi.

Trichothyrium is the only genus known to have an anamorph in this family. The genetic connection is circumstantial, and is strongly suggested by their attachment to the same kind of mycelium, but yet to be proved by ascospore cultures.

TRICHOTHYRIUM Speg., *Boln Acad. nac. Cienc. Côrdoba* **11:** 555, 1889.

Trichopeltis Speg., *Boln. Acad. nac. Cienc. Côrdoba* **11:** 571, 1889.
Trichopeltopsis Höhnel, *Sber. Akad. Wiss. Wien* **118:** 861, 1909.
Trichothyriella Theiss., *Beih. Bot. Centralbl.* **32:** 4, 1914.
Trichothyriomyces Bat. & Maia, *An. Soc. Biol. Pernamb.* **13:** 104, 1955.

(Generic synonyms after Müller & von Arx, 1962).

Type sp.: *T. asterophorum* (Berk. & Br.) Höhnel, *Sber. Akad. Wiss. Wein* **118:** 1482, 1909.

Anamorphs: *Isthmospora* F. Stev. and *Hansfordiella* S. Hughes

About five species, all hyperparasites of Meliolines on various hosts.

Colonies black, covering and following the contours of the Melioline host. Hyphae septate, smooth, pale brown to brown or dark brown, usually forming a pale to dark brown, one cell thick compact plate which is paler towards the smooth or fimbriate margin over the hyphae and hyphopodia of the Melioline and extending some distance beyond. When young, hyphae may form a loose reticulum. Thyriothecia develop from short hyphae from the margin of the plate with the upper and lower walls developing radially and lying above the hyphae. Mature thyriothecia black, shining, orbicular, ostiolate, with the margin becoming indentate with age. The upper wall is markedly radiate and composed of dark brown, closely septate hyphae of rectangular cells and the lower wall is almost flat with pale brown to brown, closely septate, rectangular cells. Asci obpyriform to clavate, thick-walled towards the apex, arranged radially, shortly pedicellate, 8 spored, with a broadly truncate-rounded to rounded apex. Ascospores clavate to fusoid clavate, smooth, one septate, hyaline, with a shorter but wider upper cell and a somewhat attenuating lower cell.

Isthmospora conidiophores branched and frequently anastomosing, smooth, pale to dark brown. Conidiogenous cells fragmenting to liberate specialized conidia (isthmospores), integrated, intercalary, determinate; initially narrow, connecting hyphae they later become lageniform or subulate and finally parallel and paired, one on each side of the conidium. Conidia solitary, dry, schizogenous, brown, smooth to echinulate, sarciniform, complex, lobed.

Hansfordiella conidiophores single or in small clusters, simple, straight or flexuous, pale to mid-brown, smooth. Conidiogenous cells monoblastic, integrated, terminal, determinate, sometimes percurrent, cylindrical, cicatrized, scars large, dark brown, cupulate with an inner

inverted cone. Conidia solitary, dry, acrogenous, simple, obclavate, rostrate, truncate at the base, brown, smooth, with several transverse septa and sometimes with oblique or vertical septa in some of the cells.

Key to Trichothyrium species with anamorphs

Anamorph *Isthmospora* 1

Anamorph *Hansfordiella* 2

1. Ascospores 14-16 × 5-6 μm, conidia in surface view 15-21 × 12-17 μm, composed of 9 cells ..... *T. asterophorum*

   Ascospores 15-20 × 5-6.5 μm, conidia in surface view 12-15 × 11-14 μm, composed of 12 cells ..... *T. reptans*

2. Ascospores 12-15 × 4.5-5.5 μm, conidia 3-4 septate, 21-34 × 6.5-9 μm ..... *T. hansfordii*

   Ascospores 20-24 × 5-6.5 μm, conidia 4-6 septate, 48-80 × 10-14 μm ..... *T. asterolibertiae*

T. asterolibertiae Deighton, *Mycol. Pap.* **78:** 28, 1960 (Fig. 62).

Anamorph: *Hansfordiella* sp.

Thyriothecia up to 190 μm broad. Asci 54-74 × 14-17 μm. Ascospores fusoid-clavate, 20-24 × 5-6.5 μm.

Conidiophores septate, up to 170 μm long and 4.5-5 μm thick, with a terminal cupiliform scar 5-6 μm wide. Conidiogenous cell percurrent with up to eighteen conidial scars. Conidia obclavate, with a truncate hilum, 4-6 septate with a long hyaline to subhyaline beak and a wider deep brown central cell with the others pale olivaceous to subhyaline, 48-80 × 10-14 μm with the beak a little more than half the whole length of the conidium. Differs from other *Hansfordiella* in the percurrent conidiogenous cell.

Hyperparasites on *Asterolibertia* sp. on *Acioa whytii* and *A. scabrifolia,* Sierra Leone.

Deighton (1960) has given a detailed account of this species with illustrations.

T. asterophorum (Berk. & Br.) Höhnel, *Sber. Akad. Wiss. Wein* **118:** 1482, 1909 (Fig. 63).

Micropeltis asterophora Berk. & Br., *J. Linn. Soc. Lond.* **14:** 131, 1873.
Trichothyrium sarciniferum Speg., *Boln Acad. nac. Cienc. Côrdoba* **11:** 556, 1889.

Anamorph: *Isthmospora spinosa* F. Stev., *Bot. Gaz.* **65:** 244, 1918.

?*Spegazzinia meliolae* Zimm., *Zbl. Bakt.* **8:** 221, 1902.
?*Spegazzinia meliolicola* Henn., *Hedwigia* **43:** 398, 1904.
Stemphylium muricatum Sacc., *Atti Acad. sci. ven.-trent.* **10:** 86, 1919.
Tetrachia singularis Sacc., *Boll. Orto bot., Napoli* **6:** 65, 1921.

Thyriothecia up to 150 μm broad. Asci 34-47 × 14-16 μm. Ascospores 14-16 × 5-6 μm.

Isthmospores in surface view 15-21 × 12-17 μm composed of nine cells, complex, lobed, sarciniform, dark brown, echinulate.

Hyperparasite of *Amazonia, Irene, Irenina, Irenopsis* and *Meliola* sp. on various hosts in the tropics, Asia, Africa, South America.

Hughes (1953) has described the development of this species in detail with excellent illustrations.

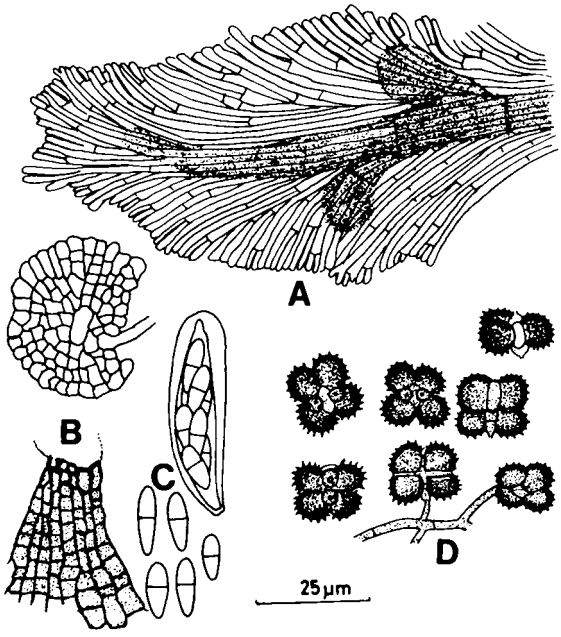


Fig. 63. *Trichothyrium asterophorum* A, colony; B, thyriothecium; C, ascus and ascospores; D, conidiophores and conidia.

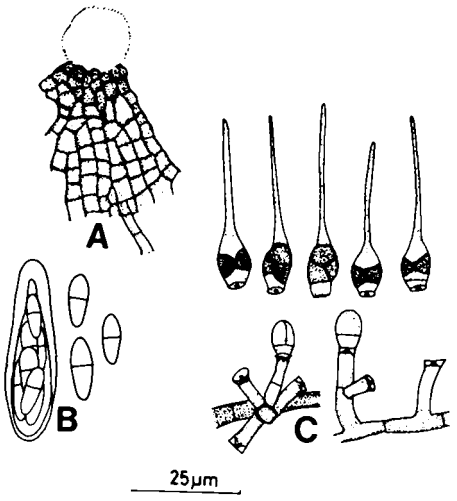


Fig. 64. *Trichothyrium hansfordii* (type). A, part of thyriothecium; B, ascus and ascospores; C, conidiophores and conidia.

T. hansfordii S. Hughes, *Mycol. Pap.* **50:** 83, 1953 (Fig. 64).

Anamorph: *Hansfordiella meliolae* (Hansf.) S. Hughes, *Mycol.Pap.* **47:** 14, 1951.

Teratosperma meliola Hansf., *Proc. Linn. Soc. Lond.* **159:** 41, 1947.

Thyriothecia up to 150 µm broad. Asci 32-40 × 12-15 µm. Ascospores 12-15 × 4.5-5.5 µm.

Conidiophores cylindrical, pale brown, 9-14 × 3-4 µm expanded at the dark apical scar. Conidia 3-4 septate, with an oblique septum in the central cell, brown, smooth, 21-34 × 6.5-9 µm with a hyaline beak up to 13 µm long, 3-3.5 µm wide.

On *Meliola* sp. on leaves of *Conopharyngia holstii* and an indet. Rubiaceae. Uganda and Ghana.

T. reptans (Berk. & M.A. Curtis) S. Hughes, *Mycol.Pap.* **50:** 85, 1953 (Fig. 65).

Asterina reptans Berk. & M.A. Curtis, *J.Linn.Soc.Lond.* **10:** 373, 1869.
Trichopeltis reptans (Berk. & M.A. Curtis) Speg., *Boln Acad.nac.Cienc.Côrdoba* **11:** 571, 1889.

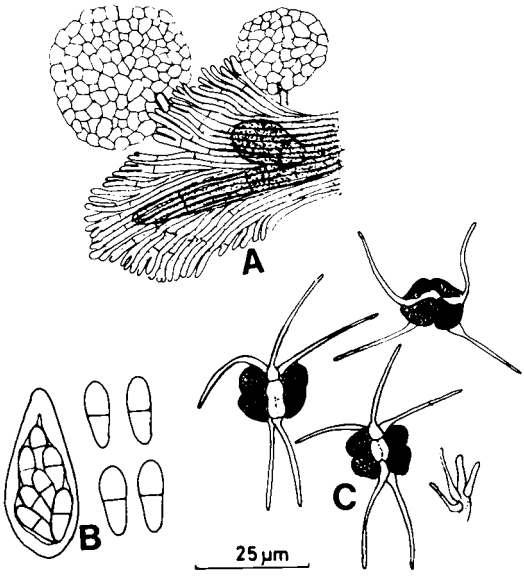


Fig. 65. *Trichothyrium reptans*. A, colony with thyriothecia; B, ascus and ascospores; C, conidiophore and conidia.

Trichothyrium serratum Speg., *Boln Acad.nac.Cienc.Côrdoba* **11:** 557, 1889.
Trichothyrium fimbriatum Speg., *Rev.Argent.Hist.nat. B. Aires* **1:** 124, 1891.
?*Microthyrium meliolarum* Pat. in Pat. & Gaillard, *Bull.Soc.mycol.Fr.* **8:** 135, 1892.
Asterina dubiosa Bomm. & Rouss., *Bull.Soc.Bot.Belg.* **35:** 157, 1896.
Microthyrium reptans (Berk. & M.A. Curtis) Pat. & Lagerh., *Bull.Herb.Boissier* **3:** 72, 1896.
Pseudomeliola ? collapsa Earle, *Bull.N.Y.Bot.Gdns* **3:** 309, 1904.
Asterina rufo-violascens Henn., *Hedwigia* **43:** 83, 1904.
Trichopeltopsis reptans (Berk. & M.A. Curtis) Höhnel, *Sber.Akad.Wiss.Wien.* **118:** 862, 1909.
Trichothyrium collapsum (Earle) Theiss., *Verh.-Zool.Bot.Ges.Wien* **69:** 16, 1919.
Trichothyrium robustum Doidge, *Bothalia* **1:** 215, 1924.
Trichothyrium caruaruense Bat. & Maia, *An.Soc.Biol.Pernamb.* **15:** 470, 1943.

Anamorph: *Isthmospora glabra* F. Stev., *Bot. Gaz.* **65:** 244, 1918.
Spegazzinia chandleri Hansf., *Proc. Linn. Soc. Lond.* **155:** 62, 1943.

Thyriothecia up to 160 µm broad, when dry cupulate, with ostiole on

raised area of concave depression with a circular, smooth margin. Asci 30-40 × 11-16 μm. Ascospores 15-20 × 5-6.5 μm.

Conidia (isthmospores) in surface view 12-15 × 11-14 μm, composed of twelve cells, lobed, sarciniform, dark brown, smooth.

Hyperparasites on species of *Irenina, Irenopsis* and *Meliola* on various hosts in Asia, Africa and South America.

Hughes (1953) has described in detail the development of both the thyriothecia and conidia of this species with good illustrations.

Dothideales

Pseudothecia separate, immersed, or seated on or immersed in stroma, uni- to multi-locular, erumpent or superficial, ostiolate or opening by rupture of the overlying tissue. Asci few to numerous arising from a broad basal hymenium or fasciculate and aparaphysate from a small basal cushion or central hemispherical cushion, or separated by remnants of interthecial tissues. Ascospores variable, one celled or septate or dictyoseptate.

Dothideaceae Chev.

Pseudothecia separate, on or in a stroma, ostiolate or non ostiolate. Asci numerous, aparaphysate arising from a basal or central or small cushion. Ascospores o-many septate or dictyoseptate.

Parasitic or saprophytic on leaves, twigs, wood and bark.

Key to genera of Dothideaceae

Ascospores non septate..... 1

Ascospores septate..... 4

1. Stromata pulvinate, parasitic on florets of carex..... *Melanodothis*

   Stromata not pulvinate..... 2

2. Stromata often botryose, parasitic or saprophytic..... *Botryosphaeria*

   Stromata absent or greatly reduced, not botryose, pseudothecia globose to subglobose, depressed globose or tympaniform..... 3

3. Pseudothecia globose to subglobose..... *Guignardia*

   Pseudothecia depressed globose to tympaniform..... *Discosphaerina*

4. Ascospores transversely septate..... 5

   Ascospores dictyoseptate..... 12

6. Ascospores one septate..... 7

   Ascospores more than one septate..... 11

7. Pseudothecia separate solitary, immersed..... 8

Pseudothecia seated on or immersed in a stroma..... 9

8. Pseudothecia deeply immersed..... *Mycosphaerella*

Pseudothecia subcuticular..... *Anthracostroma*

9. Stroma immersed..... 10

Stroma erumpent, tapering basally to a centrally attached foot..... *Microcyclus*

10. Stroma dark-coloured, with partly erumpent, uniloculate pseudothecia along the apex..... *Scirrhia*

Stroma thin, often of irregular crusts on which erumpent pseudothecia are seated..... *Cymadothea*

11. Ascospores with septum near either end, cutting off small end cells and a large central cell..... *Leptoguignardia*

Ascospores with almost equidistant septa..... *Sphaerulina*

12. Asci arising from a central hemispherical cushion..... *Pringsheimia*

Asci arising from a basal cushion..... 13

Asci 8 spored, rarely more than 8 spored, ascostroma multilocular... *Dothiora*

Asci usually more than 8 spored, ascostroma unilocular..... *Sydowia*

ANTHRACOSTROMA Petrak, *Sydowia* **8:** 96, 1954.

The genus is monotypic.

A. persooniae (Henn.) Petrak (Fig. 66).

Mycosphaerella persooniae Henn., *Hedwigia* **40:** 81, 1901.

Anamorph: *Camarosporula persooniae* (Henn.) Petrak, *Sydowia* **8:** 99, 1954.

Hendersonia persooniae Henn., *Hedwigia* **40:** 97, 1901.
Dichomera persooniae (Henn.) Henn., *Hedwigia* **42:** (87), 1903.

Ascostromata amphigenous, mostly epiphyllous, subcuticular, uni- to multi-locular, erumpent, solitary to aggregated, up to 300 μm broad, ostiolate. The wall is composed of globose to angular thick-walled, pseudoparenchymatic cells forming a textura intricata to angularis. Basal stroma one layered, with cells thick-walled, dark brown, extending over the epidermis. Asci saccate to broadly obclavate, 8 spored, 28-40 × 14-23 μm. Ascospores fusoid to narrowly obovate, hyaline, septate in the middle, 12-16 × 3-4.5 μm. Pseudoparaphysoids

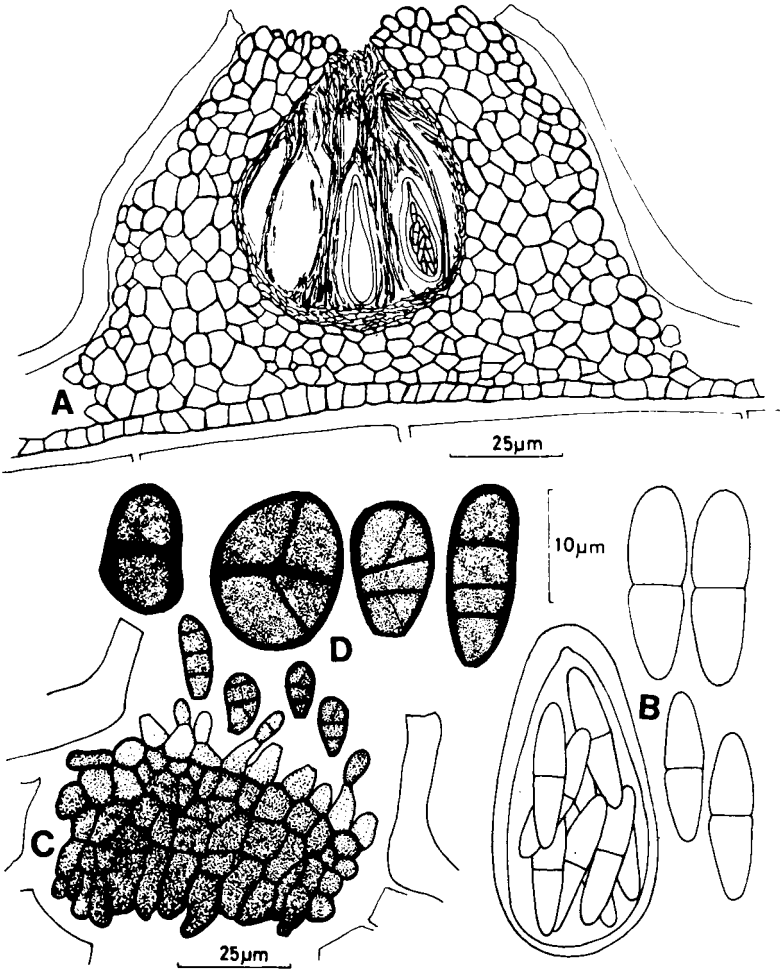


Fig. 66. *Anthracostroma persooniae.* A, v.s. ascostroma; B, ascus and ascospores; C, v.s. acervulus; D, conidia.

filamentous, branched, hyaline, indistinct.

Acervulus, amphigenous, subcuticular, epidermal to subepidermal, separate or confluent, up to 1 mm broad, composed of dark brown, thick-walled, globose to angular cells, dehiscing irregularly at the apex. Conidiophores are not distinguishable from the conidiogenous cells. Conidiogenous cells holoblastic, determinate, integrated, cylindrical to doliiform, hyaline, smooth, formed from the upper cells of the pseudoparenchyma. Conidia dictyoseptate, distoseptate, with 3 transverse septa and one or two vertical or oblique septa in each cell, thick-walled, smooth to minutely verruculose under oil, irregular or clavate to ob-

clavate, with a broad truncate base, 10-15 × 6.5-10 μm, formed singly as a terminal conidium.

On leaves of *Persoonia* spp. Australia. Causing lesions.

BOTRYOSPHAERIA Ces. & de Not., *Comm. Soc. Crittog. Ital.* **1:** 211, 1863 emend. Sacc., *Michelia* **1:** 42, 1877.

Melanops Nitschke ex Fuckel, *Symb. mycol.:* 225, 1870.
Thuemenia Rehm, *Flora* **62:** 123, 1879.
Coutinia Alm. & Cam., *Rev. Agr. de Lisboa* **1:** 392, 1903 (non Vellozo, 1799).
Cryptosporina (Henn.) Höhnel, *Sber. Akad. Wiss. Wien* **120:** 437, 1911.
Amerodothis Theiss. & H. Sydow, *Annls mycol.* **13:** 295, 1915.
Phaeobotryon Theiss. & H. Sydow, *Annls mycol.* **13:** 664, 1915.
Epiphyma Theiss., *Verh. Zool.-Bot. Ges. Wien* **66:** 306, 1916.
Pyreniella Theiss., *ibid:* 371, 1916.
Discochora Höhnel, *Ber. dt. bot. Ges.* **36:** 315, 1918.
Desmotascus F. Stev., *Bot. Gaz.* **68:** 476, 1919.
Rostrosphaeria Tehon & Daniels, *Mycologia* **19:** 112, 1927.
Neodeightonia C. Booth in Punith., *Mycol. Pap.* **119:** 19, 1969.
Caumodothis Petrak, *Sydowia* **24:** 276, 1971.

Lectotype sp.: *B. dothidea* (Moug.) Ces. & de Not., *Comm. Soc. Crittog. Ital.* **1:** 211, 1863.

Anamorphs: Pycnidial states described under *Botryodiplodia* (Sacc.) Sacc. (*Lasiodiplodia*), *Dothiorella* Sacc., *Diplodia* Fr., *Macrophoma* (Sacc.) Berl. & Vogl. and *Sphaeropsis* Sacc.

Ascocarps scattered, solitary, botryose to aggregated, stromatic, black, uniloculate, ostiolate, embedded or erumpent, with a thick pseudoparenchymatic wall composed of textura angularis or globosa with the outer layer blackened and its cells more thick-walled. Asci clavate, stalked or sessile, thick-walled, 8 spored, developing on a broad basal hymenial layer. Ascospores hyaline, continuous, often inequilateral, sometimes becoming brown mostly one celled sometimes 1-2 septate, ovoid, fusoid, fusoid-ellipsoid, ellipsoid, usually wider in the middle, thin-walled or slightly thick-walled, smooth, rarely slightly verruculose after discharge, granular, guttulate, sometimes with an evanescent apical hyaline appendage. Interthecial tissues usually disintegrating.

Botryosphaeria is distinguished from *Guignardia* by multilocular to unilocular usually stromatic pseudothecia, large ascospores and by different anamorphs. Species of *Botryosphaeria* are saprophytes or semiparasites on a wide variety of Gymnosperms and woody Angiosperms. They usually mature on dead tissues. Even though parasitic, they can be readily grown on agar culture media.

About twelve species known (von Arx & Müller, 1954; Barr, 1972).

Key to Species

Ascospores 18-46 × 10-18 μm with hyaline apical appendages at each end..... *B. laricis*

Ascospores without hyaline appendages..... 1

1. Ascospores not more than 12 μm wide..... 2

   Ascospores more than 12 μm wide..... 3

2. Ascospores 18-28 × 3.5-8 μm, fusoid..... *B. zeae*

   Ascospores 20-26 × 7-10 μm, ovoid to ellipsoid..... *B. subglobosa*

   Ascospores 17-28 × 7-12 μm, ovoid..... *B. ribis*

   Ascospores 25-33 × 7-12 μm, fusoid..... *B. obtusa*

3. Ascospores 18 μm wide or less when mature..... 4

   Ascospores usually more than 18 μm wide when mature..... 5

4. Ascospores 22-35 × 12-16 μm, hyaline, some 1-2 septate and brown..... *B. quercuum*

   Ascospores 30-40 × 12-16 μm, hyaline, rarely two septate..... *B. stevensii*

   Ascospores 30-40 × 16-18 μm, deep violet brown when mature..... *B. visci*

   Ascospores 24-42 × 7-17 μm..... *B. rhodina*

5. Ascospores 42-50 × 13-24 μm..... *B. tsugae*

   Ascospores 25-48 × 14-21 μm..... *B. melanops*

Key to Botryosphaeria conidial states

Conidia always brown when mature..... 1

Conidia hyaline to rarely yellow brown or occasionally brown when mature.. 3

1. Conidia mostly one celled..... 2

   Conidia 18-30 × 10-18 μm, septate and longitudinally striate when mature... *B. rhodina*

2. Conidia 9-12 × 6-9 μm, smooth to finely rough-walled..... *B. subglobosa*

   Conidia 20-26 × 9-12 μm, rough-walled..... *B. obtusa*

   Conidia 17-44 × 11-21 μm, smooth..... *B. laricis*

   Conidia 40-54 × 20-22 μm, smooth..... *B. visci*

3. Conidia always hyaline..... 4

   Conidia hyaline to rarely yellow brown or occasionally brown..... 5

4. Conidia 5-7 μm wide..... *B. ribis*

   Conidia 9-11 μm wide..... *B. melanops*

   Conidia 18-22 μm wide..... *B. tsugae*

5. Conidia 20-27 × 10-16 μm, rarely one septate and brown..... *B. stevensii*

   Conidia 17-40 × 5.5-11 μm, hyaline to yellow brown..... *B. zeae*

   Conidia 18-25 × 12-16 μm, rarely brown and one septate..... *B. quercuum*

B. laricis (Wehm.) von Arx & E. Müller, *Beitr. Krypt.-fl. Schweiz* **11:** 42, 1954.

Physalospora laricis Wehm., *Can. J. Res.* **20:** 585, 1942.

Anamorph: Described as a form of *Macrophoma sapinea* (Fr.) Petrak (Smerlis, 1970b).

Ascocarp subepidermal, single or in groups scattered or in rows up to 550 μm broad.The wall is up to 130 μm thick. Asci broadly clavate, 100-160 × 24-35 μm with a thickened apex. Ascospores brown, smooth, ellipsoid to ellipsoid-fusoid, guttulate, 18-46 × 10-18 μm with hyaline, generally evanescent apical appendage at each end, appendage up to 0.7 μm long.

Pycnidia similar to ascocarp but seated on a simple basal column. Conidiogenous cells hyaline, short obpyriform to cylindrical, phialidic, 7-14 × 2-5 μm, formed from the cells lining the cavity of the pycnidium. Conidia dark brown, one celled, ellipsoid, broadly cylindrical, smooth, obovate or subglobose, thick-walled, guttulate, 17-44 × 11-21 μm.

On *Larix laricina*. Canada.

Smerlis (1970b) described the pycnidial state as a form of *Macrophoma sapinea* and is most likely a *Sphaeropsis* sp. Conidia which were identical with those found in nature were obtained from monospore isolates of both ascospores and conidia (Smerlis, 1970b).

B. melanops (L.R. & C. Tul.) Winter, *Rabenh. Krypt.-fl.* **1**(2): 800, 1877 (Fig. 67).

Dothidea melanops L.R. & C. Tul., *Compt. Rend.* **42:** 705, 1856.
Melanops tulasnei (L.R. & C. Tul.) Fuckel, *Symb. mycol.:* 225, 1870.
Botryosphaeria advena Sacc., *Michelia* **1:** 42, 1877 non Ces. & de Not. 1863.

Anamorph: *Dothiorella advena* Sacc., *Michelia* **2:** 620, 1882.

Ascocarps stromatic, rounded to irregular, black, multilocular, depressed to flattened, immersed, up to 3 mm broad. Asci cylindric-clavate,

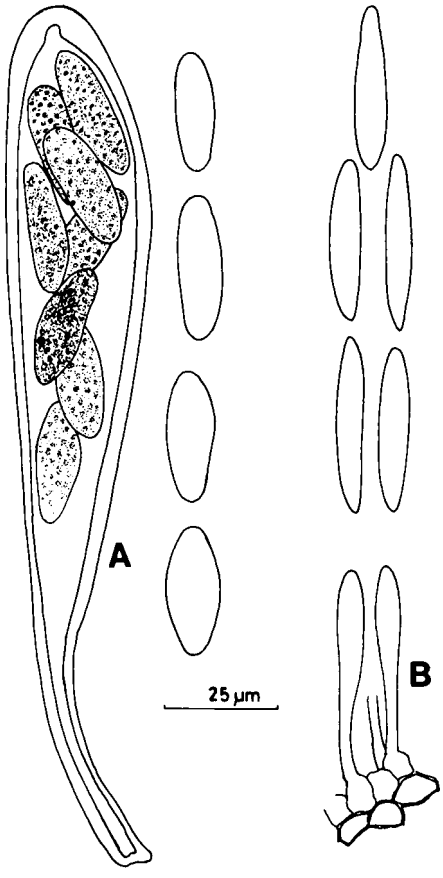


Fig. 67. *Botryosphaeria melanops*. A, ascus and ascospores; B, conidiogenous cells and conidia.

100-140 × 15-30 µm. Ascospores 25-48 × 14-21 µm, smooth, hyaline.

Pycnidia in the same stroma as the ascocarp, often associated together. Conidiogenous cells holoblastic, hyaline, formed from the cells lining the pycnidial cavity. Conidia hyaline, elongate cylindrical, straight, smooth, granulose, 41-53 × 9-11 µm. Spermogonial state with spermatia may sometimes be present.

On *Quercus*. Europe, U.S.A. and Canada

L.R. & C. Tulasne (1863) described and illustrated this species as *Dothidea melanops*. Shear & Davidson (1936) studied its life history and obtained the pycnidial state in culture from monoascospore isolates. Shoemaker (1964) has described the conidia on natural substrata.

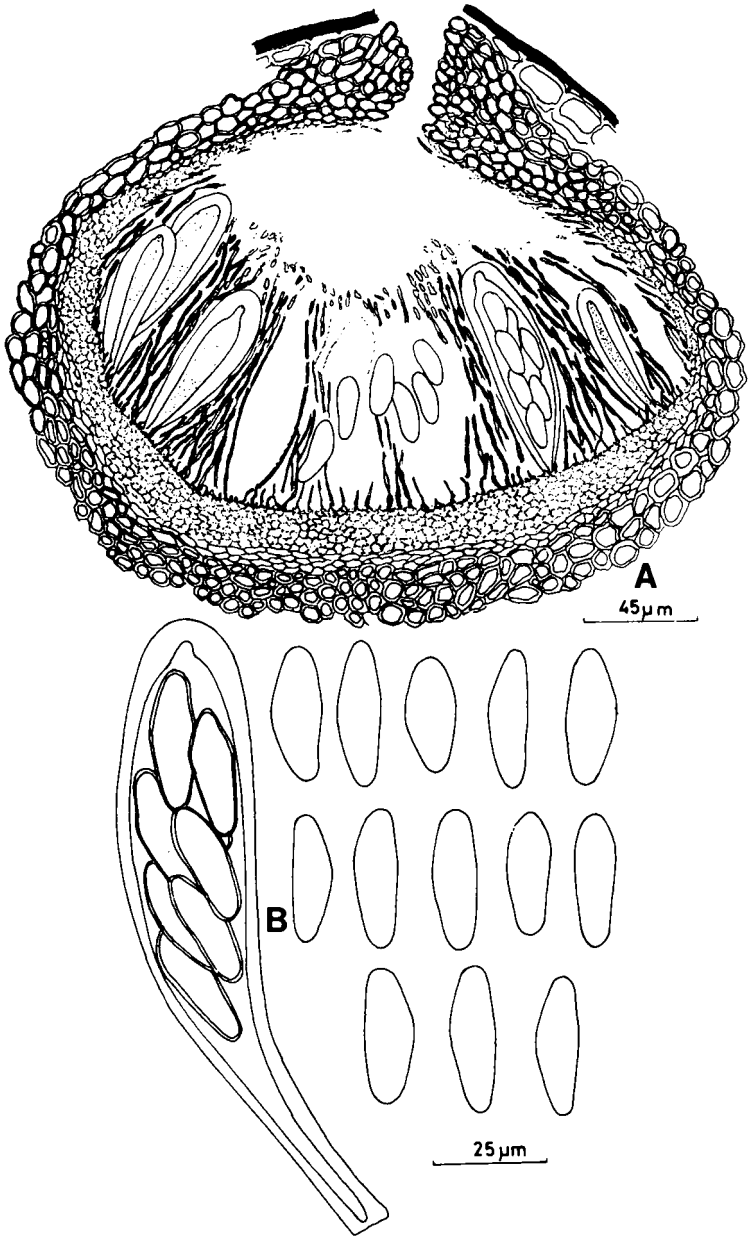


Fig. 68. *Botryosphaeria obtusa.* A, v.s. ascocarp; B, ascus and ascospores.

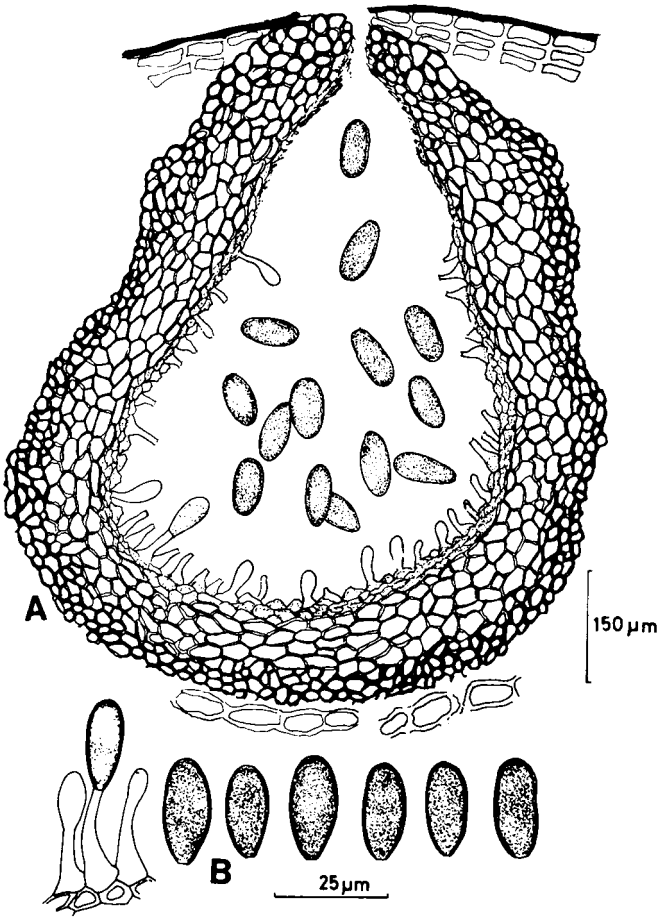


Fig. 69. *Botryosphaeria obtusa*. A, v.s. pycnidium; B, conidiogenous cells and conidia.

B. obtusa (Schwein.) Shoem., *Can. J. Bot.* **42:** 1298, 1964 (Figs. 68 & 69).

Sphaeria obtusa Schwein., *Trans. Am. Phil. Soc. Philad.* **4:** 220, 1832.
Physalospora obtusa (Schwein.) Cooke, *Grevillea* **20:** 86, 1892.

Anamorph: *Sphaeropsis* sp. (Shoemaker, 1964).

Ascocarp stromatic, immersed, solitary to botryose up to 3 mm broad. Asci clavate, 90-120 × 17-23 µm. Ascospores irregularly distichous in the ascus, broadly fusoid, wider in the middle, smooth, hyaline, 25-33 × 7-12 µm.

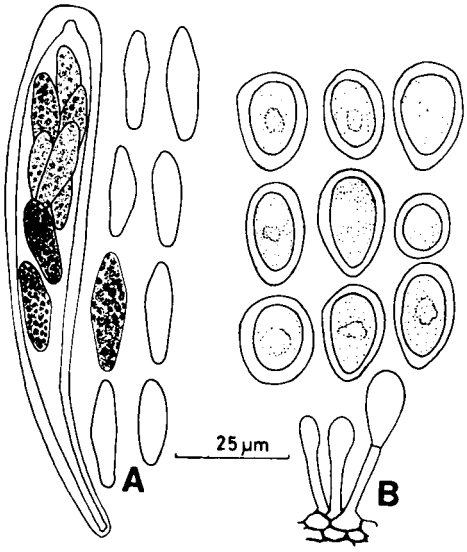


Fig. 70. *Botryosphaeria quercuum* A, ascus and ascospores; B, conidiogenous cells and conidia.

Pycnidia immersed, stromatic, solitary to botryose, ostiolate. Conidiogenous cells holoblastic, hyaline, simple, cylindrical, formed from the cells lining the pycnidial cavity. Conidia ovoid, sienna, rough-walled, 20-26 × 9-12 µm.

Causes canker and dieback of pomes and grape vines but can live saprophytically on dead wood and bark. Widespread.

The two states are frequently associated together and can be grown in artificial media. Punithalingam & Waller (1973) have given a brief description and notes on the pathogenicity of this species.

B. quercuum (Schwein.) Sacc., *Syll. Fung.* **1:** 456, 1882 (Fig. 70).

Sphaeria quercuum Schwein., *Fung. Car., Schrift. nat Ges. Leipzig* **1:** 40, 1822.
Melogramma quercuum (Schwein.) Berk., *Grevillea* **4:** 97, 1876.
Melanops quercuum (Schwein.) Weese, *Ber. dt. bot. Ges.* **37:** 94, 1919.

Ascocarps similar to *B. melanops*. Ascospores one celled, smooth, hyaline, some becoming brown and 1-2 septate, 22-35 × 12-16 µm.

Pycnidia stromatic, mixed with ascocarps. Conidiogenous cells holoblastic, hyaline, simple, formed from cells lining the cavity of the pycnidium. Conidia smooth, mostly hyaline, thick-walled, one celled,

subglobose, guttulate, rarely becoming pale brown and septate after discharge, 18-25 × 12-16 μm.

On bark of *Quercus, Carya* and other dicotyledons. Europe, America and Canada.

B. rhodina (Cooke) von Arx, *Genera of Fungi sporulating in pure culture:* 143, 1970.

Physalospora rhodina Cooke, *Grevillea* **17:** 92, 1889.

Anamorph: *Botryodiplodia theobromae* Pat., *Bull. Soc. mycol. Fr.* **8:** 136, 1892. For synonyms see Punithalingam (1980a).

Ascocarps gregarious, up to 300 μm broad. Asci 90-120 × 15-28 μm. Ascospores 24-42 × 7-17 μm, smooth, hyaline.

Pycnidia simple or compound, often stromatic, ostiolate. Conidiogenous cells holoblastic, annellidic, simple, cylindrical to somewhat obpyriform. Conidia initially hyaline, one celled, granulose, thick-walled, subovoid to ellipsoid oblong with a truncate base, mature conidia one septate, cinnamon to fawn to dark brown, longitudinally striate, 18-30 × 10-18 μm.

Ascocarps and pycnidia on leaves, stems and fruits, immersed to erumpent. The species is plurivorous causing, or associated with, many diseases (Punithalingam, 1976, 1980a).

The connection between the two states has yet to be absolutely proved but there are some inconclusive reports in the literature (Alvarez-Garcia, 1968; Stevens, 1926; Voorhees, 1942).

B. ribis Grossenb. & Duggar, *Tech. Bull. N.Y. Agr. Exp. Stn* **18:** 129, 1911 (Fig. 71).

Anamorph: *Dothiorella* sp. According to Sutton (1980) *Fusicoccum* is a possible conidial state name for this species.

Ascocarp stromatic, immersed up to 4 mm broad, botryose. Asci clavate 100-110 × 16-20 μm. Ascospores ovoid, hyaline, one celled, 17-23(28) × 7-12 μm.

Pycnidia single or botryose, globose, stromatic, ostiolate. Conidiogenous cells holoblastic, simple, hyaline formed from the cells lining the cavity of the pycnidium. Conidia of two types: macroconidia of *Dothiorella* type hyaline, fusoid, 17-25 × 5-7 μm; microconidia (spermatic) hyaline, allantoid, 2-3 × 1 μm.

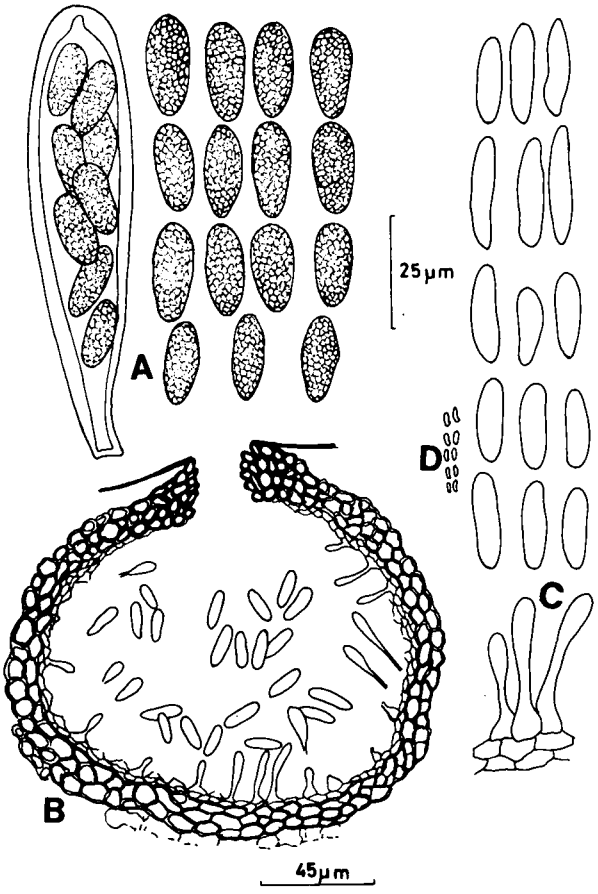


Fig. 71. *Botryosphaeria ribis.* A, ascus and ascospores; B, v.s. pycnidium; C, conidiogenous cells and conidia; D, spermatia.

According to von Arx & Müller (1954) *B. ribis* is a synonym of *B. dothidea* and *B. berengeriana. Fusicoccum aesculi* Corda is believed to be the anamorph of *B. berengeriana.*

The two states are frequently found in close association in nature. Plurivorous on many trees causing dieback and cankers on branches and stems, and fruit rot. Widespread in temperate and tropical regions of the world. For a full description, illustrations and notes on pathogenicity refer to Punithalingham & Holliday (1973).

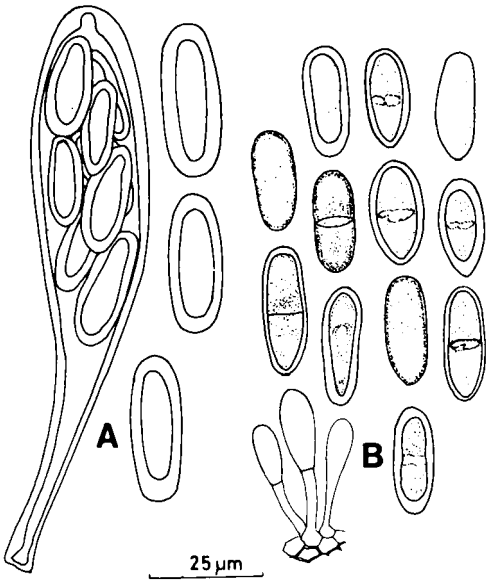


Fig. 72. *Botryosphaeria stevensii.* A, ascus and ascospores; B, conidiogenous cells and conidia.

B. stevensii Shoem., *Can. J. Bot.* **42:** 1299, 1964 (Fig. 72).

Physalospora mutila N.E. Stevens, *Mycologia* **28:** 333, 1936 (as *P. mutila* (Fr.) N.E. Stevens).

Anamorph: *Diplodia mutila* (Fr.) Mont., *Annls Sci. nat.* Ser. 2, **1:** 302, 1834.

Sphaeria mutila Fr., *Syst. mycol.* **2:** 424, 1823.

Ascocarp stromatic, immersed up to 1 mm broad. Asci 100-160 × 14-22 µm. Ascospores hyaline, smooth, one celled, thick-walled, later pale brown and rarely up to 2 septate, 30-40 × 12-16 µm.

Pycnidia solitary to aggregated, immersed, stromatic, ostiolate. Conidiogenous cells holoblastic, simple, formed from the cells lining the cavity of the pycnidium. Conidia one celled, hyaline, thick-walled, smooth, cylindric with rounded ends, guttulate in the middle, 20-27 × 10-16 µm, rarely conidia become brown and one septate.

Plurivorous. Europe, Canada and U.S.A.

Stevens (1936) obtained conidia of *D. mutila* from single ascospore isolates. The two states are found to occur separately or in the same stroma on natural substrata.

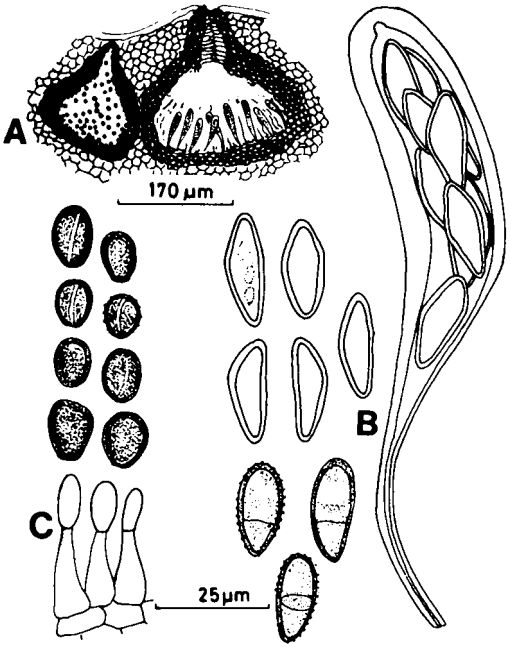


Fig. 73. *Botryosphaeria subglobosa*. A, v.s. ascocarp and pycnidium; B, ascus and ascospores; C, conidiogenous cells and conidia.

B. subglobosa (C. Booth) von Arx & E. Müller, *Stud. Mycol.* **9:** 15, 1975 (Fig. 73).

Neodeightonia subglobosa C. Booth in Punith., *Mycol. Pap.* **119:** 19, 1969.

Anamorph: *Sphaeropsis subglobosa* Cooke, *Grevillea* **7:** 95, 1879.

Ascocarps immersed, up to 300 µm broad. Asci 110-140 × 16-20 µm. Ascospores hyaline and one celled for a long time becoming brown and one septate after discharge, ovoid to broadly ellipsoidal, 20-26 × 7-10 µm, smooth or with a finely roughened surface.

Pycnidia solitary or aggregated, sometimes intermixed with ascocarps, globose, uni- to multi-locular, stromatic, up to 200 µm broad. Conidiogenous cells holoblastic, simple, hyaline. Conidia (phialospores) spherical to globose, pale to dark brown when mature, smooth to finely rough-walled, 9-12 × 6-9 µm.

On dead culms of *Bambusa arundinacea*. Sierra Leone. The fungus is homothallic and monoascosporic isolates form both ascus and pycnidial states in culture (Punithalingam, 1969).

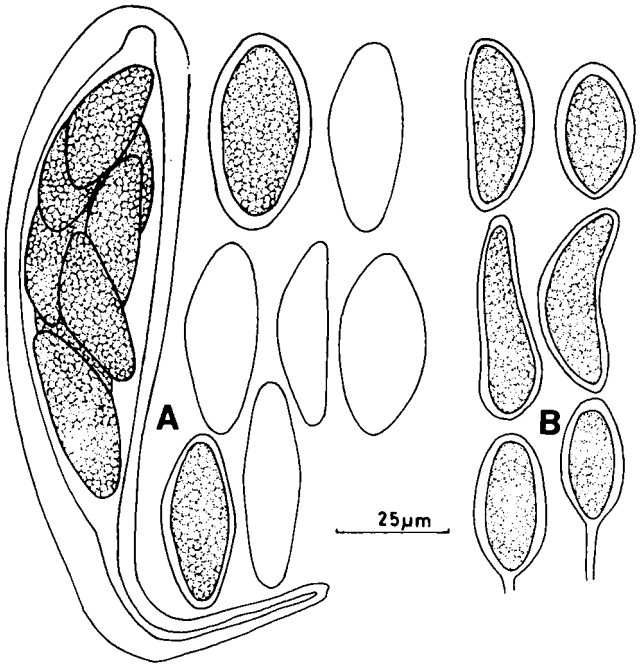


Fig. 74. *Botryosphaeria tsugae*. A, ascus and ascospores; B, conidia.

B. tsugae Funk, *Can. J. Bot.* **42:** 770, 1964. (Fig. 74).

Anamorph: *Macrophoma* sp.

Ascocarp immersed, globose to subglobose, up to 540 μm broad. Asci clavate, 140-180 × 30-36 μm. Ascospores ellipsoid to fusoid, sometimes inequilateral, smooth, hyaline, one celled, 42-50 × 13-24 μm, becoming pale brown at maturity.

Pycnidia immersed, subglobose, ostiolate, up to 540 μm broad. Conidiogenous cells holoblastic, simple, hyaline. Conidia oblong to ovoid, one celled, hyaline, 36-41 × 18-22 μm.

Causes cankers and dieback of *Tsuga heterophylla* in British Columbia. Both the pycnidia and ascocarps are closely associated on the host and the fungus can be grown in culture. Funk (1964) obtained conidia in culture from monoascosporic isolates.

B. visci (Kalchbr.) von Arx & E. Müller, *Beitr. Kryptogamenfl. Schweiz* **11:** 41, 1954.

Dothidea visci Kalchbr., *Hedwigia* **8:** 117, 1869.
Phaeobotryon visci Höhnel, *Sber. Akad. Wiss. Wien* **128:** 592, 1919.

Anamorph: *Sphaeropsis visci* (Fr.) Sacc., *Michelia* **2:** 105, 1880.

Sphaeria atrovirens Alb. & Schwein.: Fr. *visci* Fr., *Syst. mycol.* **2:** 501, 1823.
Sphaeria visci DC., *Fl. franc.* **6:** 146, 1815.
Ceuthospora visci Sollm., *Hedwigia* **2:** 187, 1863.
Macrophoma visci Aderh., *Arb. Biol. Anst. Land- u. Forstw.* **4:** 462, 1905.
Botryosphaerostroma visci (Sollm.) Petrak, *Annls mycol.* **21:** 120, 1923.
Botryosphaerostroma visci (DC.) Petrak in Petrak & H. Sydow, *Beih. Rep. spec. nov. regni veg.* **42:** 127, 1927.

Ascocarp immersed below the epidermis, upto 500 μm broad. Asci 120-160 × 30-40 μm. Ascospores hyaline at first becoming dark violet brown, 30-40 × 16-18 μm.

Pycnidia immersed to erumpent and superficial, unilocular, upto 300 μm broad. Conidiogenous cells, 4-8 × 4-6 μm. Conidia 40-54 × 20-22 μm, brown, smooth.

On branches and leaves of *Viscum album*. Europe.

B. zeae (Stout) von Arx & E. Müller, *Beitr. Krypt.-fl. Schweiz* **11:** 40, 1954 (Fig. 75).

Physalospora zeae Stout, *Mycologia* **22:** 282, 1930.

Anamorph: *Macrophoma zeae* Tehon & Daniels, *Mycologia* **19:** 121, 1927.

Ascocarps stromatic, solitary or in groups up to 250 μm broad. Asci cylindrical, 55-125 × 9-16 μm. Ascospores hyaline to very pale yellow brown, fusoid, tapering to rounded ends, smooth, thin-walled, 18-28 × 3.5-8 μm.

Pycnidia superficial or immersed, erumpent, solitary or in groups, ostiolate, up to 200 μm broad, globose to subglobose. Conidiogenous cells holoblastic, simple, arising from the cells lining the cavity of the pycnidium. Conidia hyaline to yellow brown, ovoid to bluntly fusoid, smooth, one celled, later developing one or more septa prior to germination, 17-40 × 5.5-11 μm, extruded in slimy droplets from the ostiole. Spermogonia similar to pycnidia. Spermatia hyaline, one celled, 2.5-4.5 × 1-2 μm.

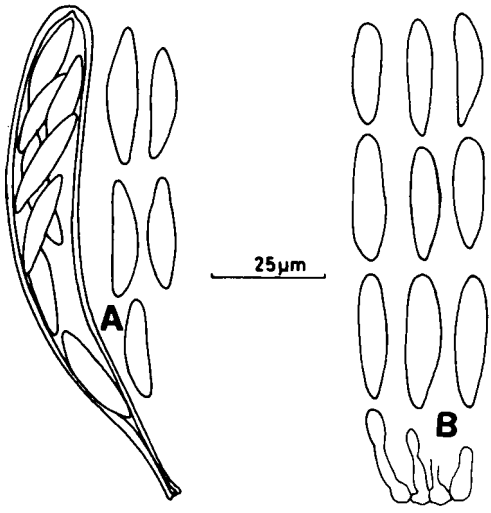


Fig. 75. *Botryosphaeria zeae.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Causing grey ear-spot of maize. South Africa and U.S.A. The genetic connection between the ascus and the pycnidial state has been conclusively proved by Bezuidenhout & Marasas (1978). The pycnidial state although described as *M. zeae* belongs to *Dothiorella.*

CYMADOTHEA Wolf, *Mycologia* **27:** 71, 1935.

The genus is monotypic.

C. trifolii (Killian) Wolf, *Mycologia* **27:** 71, 1935 (Fig. 76).

Plowrightia trifolii Killian, *Rev. Path. Vég. Ent. Agr. Fr.* **10:** 219, 1923.
Dothidella trifolii Bayliss-Elliott & Stansf., *Trans. Br. mycol. Soc.* **9:** 218, 1924.
Mycosphaerella killianii Petrak, *Annls mycol.* **39:** 324, 1941.

Anamorph: *Polythrincium trifolii* Kunze in Schmidt & Kunze, *Mykol. Hefte* **1:** 14, 1917.

Microconidial state: *Placosphaeria trifolii* (Pers.) Trav., *Annls mycol.* **1:** 311, 1903.

Colonies effuse or punctiform, olivaceous brown. Mycelium immersed.

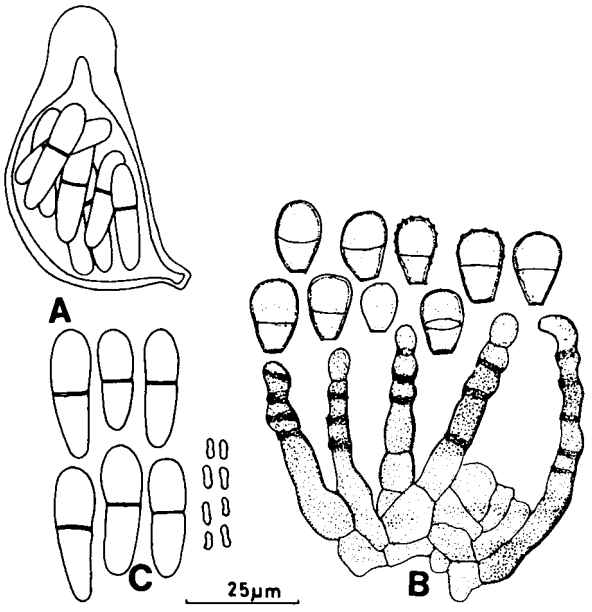


Fig. 76. *Cymadothea trifolii.* A, ascus and ascospores; B, conidiophores and conidia; C, spermatia.

Stroma pseudoparenchymatous, brown to black. Ascocarp uni- to multi-loculate, erumpent with conical apices. Asci 50-55 × 20-30 μm. Ascospores hyaline, obovate, straight, or inequilateral, 22-27 × 6-7.5 μm. Pseudoparaphysoids indistinct.

Conidiophores in groups, unbranched, upper part curved and often thickened on the side away from the curvature, undulate, often torsive, mid pale brown, smooth, up to 100 × 6-9 μm. Conidiogenous cells sympodial, terminal, undulate, cylindrical, cicatrized, with large unilateral flat scars. Conidia solitary acropleurogenous, simple, cuneiform or pyriform, hyaline to pale brown, smooth or verrucose, 1-septate, 17-24 μm long, 13-24 μm thick in the broadest part, 4-5 μm at the base. Microconidia hyaline, minute, one celled.

On leaves of *Trifolium* causing sooty blotch disease. Ethiopia, Europe, India, Iraq, Israel, Jamaica, Kenya, New Zealand, N. America, Pakistan.

DISCOSPHAERINA Höhnel, *Sber. Akad. Wiss. Wien* **126:** 353, 1917.

Myriocarpa Fuckel, *Symb. mycol.:* 116, 1870, non Bentham, 1844.
Columnosphaeria Munk, *Dansk Bot. Arkiv* **15:** 103, 1953.

Type sp.: *D. discophora* Höhnel, *Sber. Akad. Wiss. Wien* **126:** 353, 1917.

Anamorphs: *Kabatia* Bubak, *Selenophoma* Maire and *Sarcophoma* Höhnel. Some species produce a *Hormonema* or *Aureobasidium*-like state in culture.

Spermatial state: *Leptodothiorella* Höhnel *sensu* Sydow ex van der Aa (1973).

Pseudothecia depressed globose to tympaniform, black, immersed, scattered or aggregated, connected often by thick hyphae and sometimes forming a stromatic crust, ostiolate at maturity usually by dehiscence of the thin wall at the apex. The thin wall of 2-3 layers, is composed of polygonal cells. Asci oblong to ovoid, numerous, fasciculate, sessile or mostly stalked, 8 spored, sometimes 4, 16 or more spored. Asci overlapping biseriate or triseriate in the ascus, hyaline, one celled, guttulate, elliptic, obovate, oblong to fusoid, smooth, rarely becoming olivaceous and punctate with age, sometimes enveloped in a thin mucilaginous sheath when young. Pseudoparaphysoids absent.

Kabatia acervulus, flat, single, subcuticular, unilocular composed of a basal wall of hyaline, large, thin-walled cells of textura angularis and an upper wall of one cell thick, dark brown, thick-walled cells converging towards the middle and becoming hyphal, opening by radial rupture between hyphae of the upper wall. Conidiogenous cells holoblastic, determinate, discrete, doliiform to cylindrical, hyaline, smooth, confined to the basal wall. Conidia hyaline, thin walled, smooth, pointed or rostrate, clavate, fusiform, cylindrical or falcate, with an obtuse apex and truncate base.

For descriptions of *Selenophoma* and *Sarcophoma* pycnidial anamorphs refer to *D. cytisi* and *D. miribelii* respectively.

von Arx & Müller (1954, 1975) placed *Discosphaerina* as a synonym of *Guignardia,* while Barr (1972) keeps it as a distinct genus. *Discosphaerina* is separated from *Guignardia* by a relatively thin walled peridium, tympaniform to depressed globose pseudothecia and by *Kabatia, Selenophoma* or *Sarcophoma* anamorphs.

Key to Discosphaerina species with anamorphs

Anamorph *Sarcophoma,* ascospores 13-19 × 5-7 μm, conidia 9-12 × 4.5-5.5 μm ..... *D. miribelii*

Anamorph *Selenophoma*..... 1

Anamorph *Aureobasidium*..... 2

Anamorph *Kabatia*..... 3

1. Ascospores 13-27 × 4-8 μm, conidia 25-30 × 5-5.5 μm..... *D. cytisi*

   Ascospores 15-18 × 4.5-6 μm, conidia 17-22 × 5-7 μm..... *D. boltoniae*

2. Ascospores 12-22 × 5-7.5 μm, conidia 5.5-18 × 3.5-10 μm..... *D. fagi*

   Ascospores 12-16 × 4-5 μm, conidia 11-16 × 4-5.5 μm..... *D. fulvida*

3. Conidia one celled, 18-38 × 6-12 μm, ascospores 11-16 × 6-7.5 μm..... ..... *D. xylostei*

   Conidia one septate..... 4

4. Ascospores 10-12.5 × 3-6 μm, conidia 23-35 × 13-16 μm... *D. himalayensis*

   Ascospores 12-19 × 6.5-8 μm, conidia 25-43 × 5-7 μm..... *D. lateramensis*

   Ascospores 12-17 × 6-7.5 μm, conidia 21-46 × 6.5-12 μm..... *D. mirabilis*

D. boltoniae (Dearn. & Barth.) Barr, *Contr. Univ. Michigan Herb.* **9:** 580, 1972 (Fig. 77 C,D).

Guignardia boltoniae Dearn. & Barth., *Mycologia* **18:** 245, 1926.

Anamorph: *Selenophoma boltoniae* (Dearn. & Barth.) comb. nov.

Macrophoma boltoniae Dearn. & Barth., *Mycologia* **18:** 245, 1926.

Ascocarp up to 120 μm broad, scattered. Asci 57-60 × 15-18 μm. Ascospores elliptic or fusoid, 15-18 × 4.5-6 μm.

Pycnidia similar to ascocarps. Conidia hyaline, fusoid, 17-22 × 5-7 μm. Spermogonia similar to pycnidia with hyaline, one celled, oblong spermatia measuring 6-7.5 × 2-3 μm.

The connection has yet to be proved by cultural study.

On stalks of *Boltonia diffusa*. U.S.A.

D. cytisi (Fuckel) comb. nov.

Myriocarpa cytisi Fuckel, *Symb. mycol.* **7:** 116, 1870.
Physalospora euganea Sacc., *Michelia* **1:** 244, 1878.
Anthostomella cytisi (Fuckel) Sacc., *Syll. Fung.* **1:** 290, 1882.

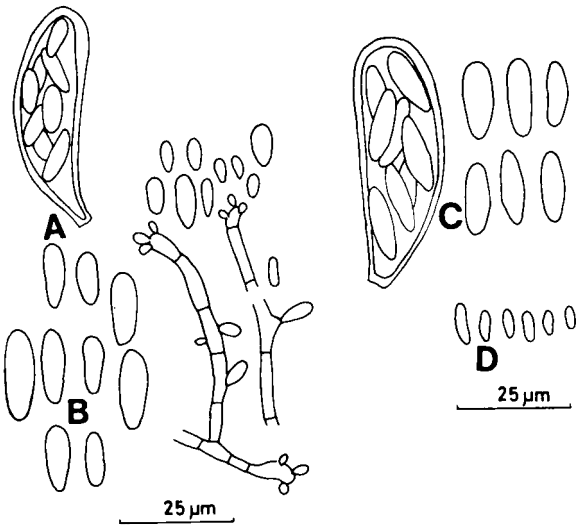


Fig. 77. *Discosphaerina fagi* (type). A, ascus; B, conidiogenous hyphae and conidia. *D. boltoniae*. C, ascus and ascospores; D, conidia.

Paranthostomella cantacurzinoi Sãvul., *ibid.* **7:** 7, 1934.
Laestadia spartii Pass., *Rend. R. Acad. Lincei, Roma* **7:** 44, 1891.
Carlia euganea (Sacc.) Höhnel, *Annls mycol.* **2:** 43, 1904.
Guignardia hispanica Bubak & Frag., *Hedwigia* **57:** 4, 1917.
Phaeobotryon euganeum (Sacc.) Höhnel, *Annls mycol.* **18:** 82, 1920.
Physalospora albanica Petrak, *Annls mycol.* **19:** 99, 1921.
Physalospora euganoides Petrak, *Annls mycol.* **22:** 58, 1924.
Paranthostomella cytisi (Fuckel) Sãvul., *Arch. roum. Path. exp. Microbiol.* **7:** 16, 1934.
Guignardia cytisi (Fuckel) von Arx & E. Müller, *Beitr. Kryptogamenfl. Schweiz* **11:** 49, 1952.
Discosphaerina euganea (Sacc.) Petrak, *Sydowia* **7:** 85, 1953.
Columnosphaeria sarothamni Munk, *Dansk Bot. Arkiv* **15:** 2, 103, 1953.

Anamorph: *Selenophoma juncea* (Mont.) von Arx, *Verh. Akad. Wet. Amst.* **51:** 139, 1957.

Sacidium junceum Mont., *Ann. Sci. nat. ser.* 4, **5:** 341, 1856.
Cryptosporium lunulatum Bauml., *Beitr. Crypt. Fl. Pressb. Comit.:* 26, 1887.
Gloeosporium subfalcatum Bomm., Rouss & Sacc., *Contr. Myc. Belg.* **4:** 90, 1891.
Myxosporium subfalcatum (Bomm., Rouss & Sacc.) Allesch. in Rabenh., *Krypt. Fl. Dtsch.* **7:** 531, 1903.
Phlyctaena junceum (Mont.) Höhnel, *Sber. Akad. Wiss. Wien* **119:** 662, 1910.

Cryptosporium ludwigii Sacc., *Annls mycol.* **11:** 18, 1913.
Falcispora androssowii Bubak & Serebr., *Hedwigia* **52:** 169, 1912.
Sarcophoma juncea (Mont.) Höhnel, *Sber. Akad. Wiss. Wien* **125:** 110, 1916.
Selenophomopsis juncea (Mont.) Petrak, *Annls mycol.* **22:** 182, 1924.

Pseudothecia up to 300 μm broad. Asci 45-90 × 11-20 μm, mostly 8 spored, sometimes 4, 16 or more spored. Ascospores 13-27 × 4-8 μm with apical caps.

Pycnidia immersed to superficial, solitary to aggregated, globose, dark brown, non ostiolate, unilocular, up to 200 μm broad, thin-walled, of textura angularis. Conidiogenous cells enteroblastic, phialidic, discrete, determinate, hyaline to brown, smooth with 1-3 apertures, 15-20 × 4-7 μm, with a minute collarette and channel. Conidia one celled, falcate, fusiform, smooth to verruculose, hyaline to brown, 25-30 × 5-5.5 μm.

On dead stems of *Glycyrrhiza glandulifera, Sarothamnus scoparius, Spartium junceum,* Europe.

D. fagi (Hudson) Barr, *Contr. Univ. Michigan Herb.* **9:** 580, 1972 (Fig. 77 A,B).

Guignardia fagi Hudson, *Nova Hedwigia* **10:** 323, 1966.

Anamorph: *Aureobasidium*-like.

Ascocarps up to 120 μm broad, epiphyllous, grouped along the sides of the main veins of the leaf. Asci 45-85 × 9-16 μm. Ascospores fusoid, 12-22 × 5-7.5 μm, sometimes with a thin mucilaginous sheath.

Aureobasidium-like anamorph is produced in culture from ascospores. Colonies white to black. Conidiogenous cells intercalary or terminal, forming blastic conidia, denticulate or with minute scar. Conidia one celled, rarely 1 septate, hyaline, smooth, elliptic-oblong, 5.5-18 × 3.5-10 μm. Secondary conidia and endoconidia are sometimes formed.

On *Acer, Fagus.* Europe, U.S.A.

Klebahn (1918) described *Guignardia niesslii* and *G. pullulans* both with *Aureobasidium*-like anamorphs and suggested that these two are alike. Klebahn's material of these fungi cannot be traced.

D. fulvida (Sanderson) comb. nov.

Guignardia fulvida Sanderson, *N.Z. Jl Agric. Res.* **8:** 139, 1965.

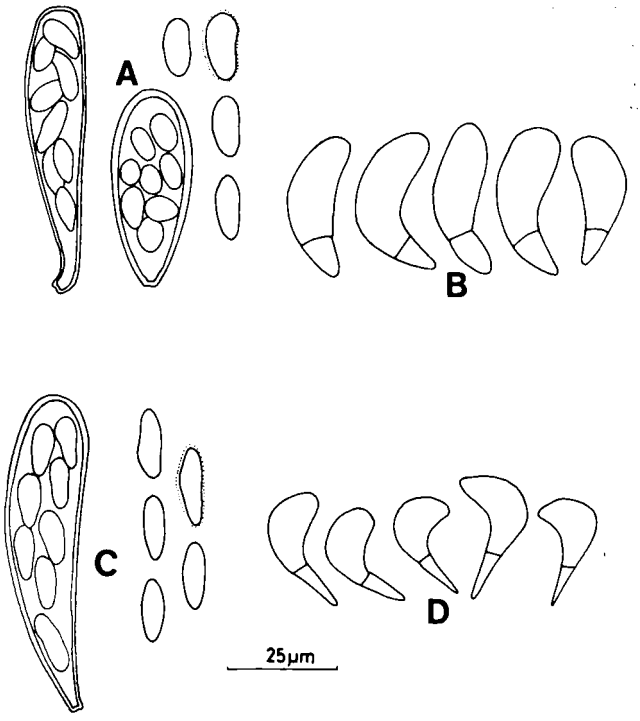


Fig. 78. *Discosphaerina himalayensis.* A, asci and ascospores; B, conidia; *D. mirabilis.* C, ascus and ascospores; D, conidia.

Anamorph: *Aureobasidium lini* (Lafferty) Hermanides-Nijhof, *Stud. Mycol.* **15:** 153, 1977.

Polyspora lini Lafferty, *Scient. Proc. R. Dubl. Soc.* **16:** 258, 1920-22.
Pullularia pullulans (de Bary) Berkhout var. *lini* (Lafferty) White, *J. Counc. Sci. Ind. Res. Aust.* **18:** 141, 1945.
Kabatiella lini (Lafferty) Karakulin in Vassil. & Karakulin, *Fungi Imper. Paras.* **2:** 209, 1950.
Microstoma lini (Lafferty) Krenner, *Agrártudományi* **6:** 42, 1954.
Aureobasidium pullulans (de Bary) Arnaud var. *lini* (Lafferty) W.B. Cooke, *Mycopath. Mycol. appl.* **17:** 34, 1962.

Ascocarps solitary to aggregated, on a poorly developed stroma, up to 135 µm broad. Asci 60-65 × 10-12 µm. Ascospores obovate to elliptical, sometimes slightly allantoid, 12-16 × 4-5 µm.

Aureobasidium anamorph was obtained from ascospores by Sanderson (op. cit., 1965). Colonies velvety with smooth margins, in older cultures

hyphae thick-walled. Conidiogenous cells undifferentiated, intercalary or terminal forming blastic conidia simultaneously in a scattered or dense group, denticulate or with minute scar. Conidia one celled, hyaline, smooth, ellipsoidal, variable in size, 11-16 × 4-5.5 μm. Smaller secondary conidia are sometimes formed. Endoconidia ellipsoidal, 8-15 × 3.5-4.5 μm.

On *Linum*. Australia, Canada, Ireland, New Zealand, Russia.

D. himalayensis (E. Müller) comb. nov. (Fig. 78 A,B).

Guignardia himalayensis E. Müller, *Phytopath. Z.* **34:** 414, 1959.

Anamorph: *Kabatia* sp.

Ascocarps similar to that of *D. mirabilis*. Asci 50-65 × 12-15 μm. Ascospores 10-12.5 × 3-6 μm. Conidia 23-35 × 13-16 μm septate at the base.

On *Lonicera quinquelocularis*. Himalayas.

D. latemarensis (E. Müller) Petrak, *Sydowia* **11:** 444, 957 (Fig. 79).

Guignardia latemarensis E. Müller, *Sydowia* **7:** 329, 1953.

Anamorph: *Kabatia latemarensis* Bubak, *Österr. Bot. Zeit.* **54:** 8, 1904. *Kabatia lonicerae* (Hark.) Höhnel var. *latemarensis* (Bubak) Conners, *Can. J. Bot.* **37:** 425, 1959.

Ascocarps up to 200 μm broad. Asci 60-75 × 14-17 μm. Ascospores ellipsoidal, 12-19 × 6.5-8 μm, with hyaline, mucilaginous apical appendages.

Conidiomata (acervulus) up to 200 μm broad, subcuticular. Conidiogenous cells hyaline, cylindrical, 18-28 × 6-8 μm. Conidia 1 septate, 25-43 × 5-7 μm, with a longer basal cell.

On *Lonicera coerula*. Europe, Canada.

D. mirabilis (E. Müller) comb. nov. (Fig. 78, C,D).

Guignardia mirabilis E. Müller, *Phytopath. Z.* **34:** 412, 1959.

Anamorph: *Kabatia mirabilis* Bubak, *Österr. Bot. Zeit.* **55:** 241, 1905.

Ascocarps up to 170 μm broad. Asci 45-80 × 10-16 μm. Ascospores ellipsoidal, often inequilateral, 12-17 × 6-7.5 μm.

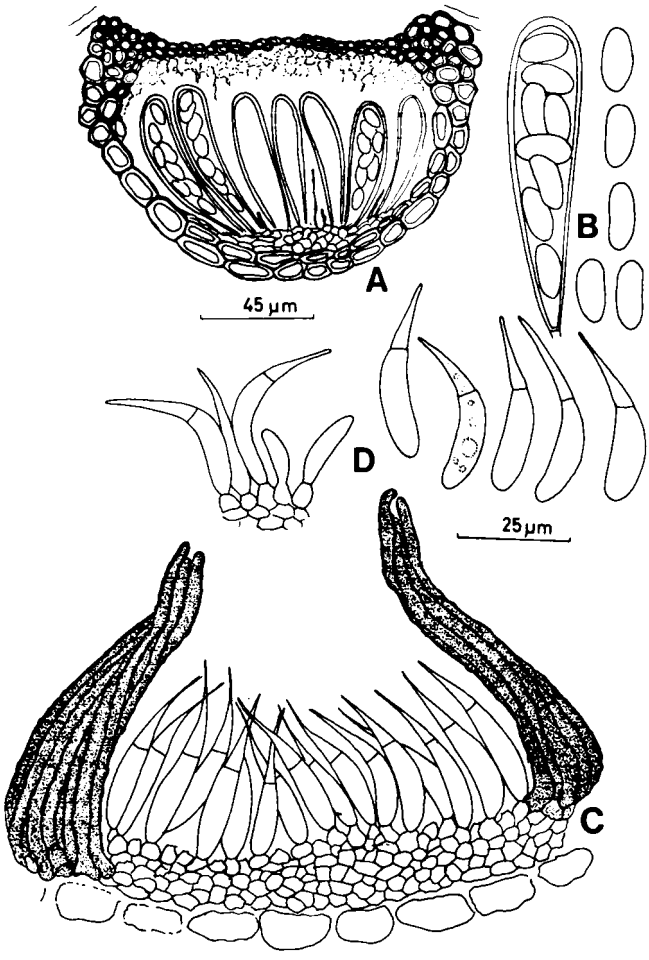


Fig. 79. *Discosphaerina latemarensis* (type). A, v.s. ascocarp; B, ascus and ascospores; C, v.s. acervulus; D, conidiogenous cells and conidia.

Acervulus yellowish buff. Conidia 21-46 × 6.5-12 µm, 1 septate, with larger and wider basal cell.

On *Lonicera alpigena* and *L. nigra*. Italy, Switzerland, Czechoslovakia.

D. miribelii (van der Aa) comb. nov.

Guignardia miribelii van der Aa, *Persoonia* **8**: 283, 1975.

Anamorph: *Sarcophoma miribelii* (Fr.) Höhnel, *Hedwigia* **60:** 133, 1918.

Sphaeria miribelii Fr., *Linnaea* **5:** 548, 1830.
Sphaeria delitescens Wallr., *Fl. crypt. Germ.* **2:** 777, 1833.
Sphaeropsis miribelii (Fr.) Lév., *Annls Sci. nat. ser.* 3, **5:** 296, 1846.
Phacidium buxi Lasch. in Klotsch, *Herb. viv. mycol.* **1:** 1154, 1847.
Gloeosporium pachybasium Sacc., *Michelia* **2:** 117, 1880.
Phoma miribelii (Fr.) Sacc., *Michelia* **2:** 90, 1880.
Phoma phacidioides Sacc., *Michelia* **2:** 274, 1881.
Phoma delitescens (Wallr.) Sacc., *Syll. Fung.* **3:** 105, 1884.
Macrophoma miribelii (Fr.) Berl. & Vogl., *Atti Soc. ven.-trent. Sci. nat.* **10:** 179, 1886.
Gloeosporium louisiae Baumler, *Verh. Ver. Natur-Heik. Pressburg N.F.* **9:** 100, 1896.
Phyllosticta phacidioides (Sacc.) Allesch. in Rabenh. *Kryptog.-Fl.* **1:** 25, 1898.
Macrophoma miribelii (Fr.) Berl. & Vogl. f. *ramicola* Oudem., *Ned. kruidk. Arch.* III **2:** 734, 1902.
Sacrophoma endogenospora Höhnel, *Sber. Akad. Wiss. Wien* **125:** 76, 1916.
Sclerophoma confusa Petrak, *Annls mycol.* **20:** 23, 1922.
Phyllostictina confusa (Petrak) Petrak in Petrak & Sydow. *Beih. Rep. Spec. nov. Veg.* **42:** 191, 1927.

Ascocarp immersed in the bark, tympaniform, apically flattened, opening in the middle by dehiscence of the thin wall, up to 350 μm broad. Asci 75-180 × 15-20 μm, 16 or 32 spored. Ascospores ellipsoidal or ovate, hyaline and smooth for a long time, when young enclosed in a thin mucilaginous sheath, with age becoming olivaceous and finely punctate, 13-19 × 5-7 μm.

Pycnidia stromatic, globose to flattened, immersed, at maturity dehiscing by an irregular rupture of the covering wall, unilocular, dark brown, up to 200 μm broad. The apical and lateral wall is composed of pale brown, thin-walled cells forming a textura angularis and the basal wall consists of parallel rows of hyaline to subhyaline thin-walled cells. Conidiogenous cells lining the pycnidial cavity, enteroblastic, phialidic, discrete, determinate, hyaline, smooth, ampulliform to doliiform, 7-10 × 5-9 μm. Conidia formed in basipetal succession, one celled, hyaline, ellipsoidal, ovoid or pyriform, apiculate at the base, guttulate, 9-12 × 4.5-5.5 μm.

In culture a *Hormonema* state is also produced. Hyphae hyaline to brown, smooth, thick-walled, septate. Conidiogenous cells undifferentiated, forming conidia basipetally from one or more conidiogenous loci. Conidia hyaline, smooth, ellipsoidal, 10-15.5 × 6-8.5 μm. New

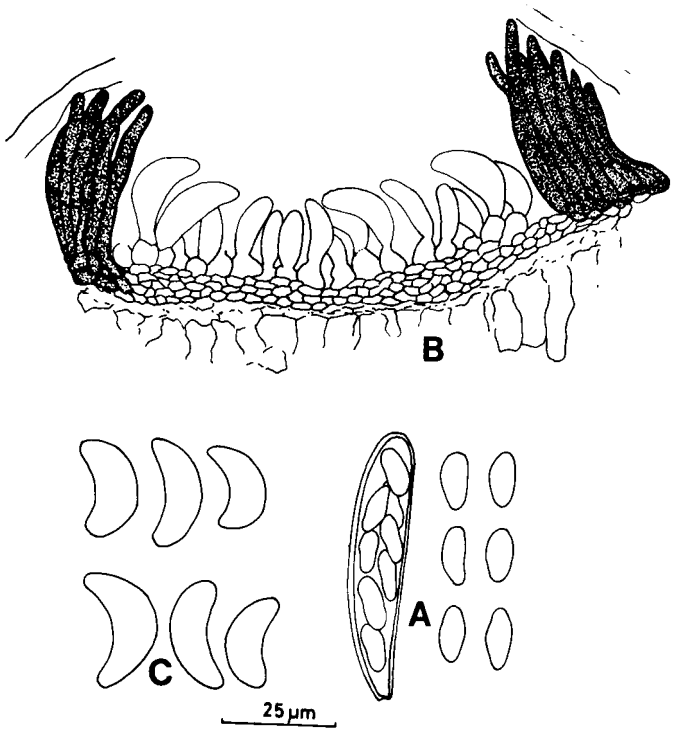


Fig. 80. *Discosphaerina xylostei.* A, ascus and ascospores; B, v.s. acervulus; C, conidia.

conidia are percurrently produced after detachment of the first conidium. Endoconidia (intercalary and terminal chlamydospores) are also formed.

On twigs and leaves of *Buxus sempervirens, B. arborescens,* and *Buxus* spp. Australia, Europe.

D. xylostei (Reusser) comb. nov. (Fig. 80).

Guignardia xylostei Reusser, *Phytopath. Z.* **51:** 223, 1964.

Anamorph: *Kabatia periclymeni* (Desm.) Morelet var. *xylostei* (Pass.) B. Sutton, *The Coelomycetes:* 168, 1980.

Depazea xylostei Pass., *Hedwigia* **16:** 117, 1877.
Labrella xylostei (Pass.) Fautr., *Rev. Mycol.* **17:** 168, 1895.
Colletotrichella xylostei (Pass.) Höhnel, *Ber. dt. bot. Ges.* **37:** 106, 1919.

Leptothyrium periclymeni (Desm.) Sacc. var. *xylostei* (Pass.) Conners, *Can.J. Bot.* **37:** 423, 1959.

Ascocarp up to 130 μm broad. Asci clavate to ellipsoidal, 45-70 × 10-15 μm. Ascospores broadly ellipsoidal, 11-16 × 6-7.5 μm with apical mucilaginous appendages.

Acervulus subcuticular. Conidia falcate, hyaline, one celled, 18-38 × 6-12 μm.

On *Lonicera hispida, L. xylosteum.* Europe.

DOTHIORA Fr., *Summa veg. Scand:* 418, 1849 (name only in *Flora Scanica:* 347, 1835-37).

Plowrightia Sacc., *Syll. Fung.* **2:** 635, 1883.
Dothiora subgenus, *Metadothis* Sacc., *Syll. Fung.* **8:** 764, 1889.
Leptodothiora Höhnel, *Ber. dt. bot. Ges.* **36:** 311, 1918.

Type sp.: *D. pyrenophora* (Fr.) Fr., *Summa veg. Scand.:* 418, 1849.

Anamorph: *Dothichiza* Lib. (Froidevaux, 1972).

Cultures of *Dothiora* also produce a *Hormonema* state morphologically similar to *H. dematioides* (Hermanides-Nijhof, 1977).

Stroma rather large, pulvinate to depressed globose, immersed becoming erumpent, black, with a plane, broadly rounded to short papillate apex opening by an irregular, small pore, multiloculate, composed of a thick-wall of several layers of dark brown cells forming a textura angularis, often arranged in vertical rows, with the cells forming the basal cushion and the inner layers smaller and somewhat compressed and completely filling the locule before the development of asci. Asci oblong to short clavate, arising from the basal cushion and dissolving the locule tissue, 8 or more spored. Ascospores hyaline, rarely yellow to pale brown, obovate to elliptic, often inequilateral or slightly curved, one to many septate, usually constricted at the primary median septum, sometimes with a vertical septum in one or several of the central cells and rarely in the end cells, smooth, occasionally surrounded by a thin mucilaginous sheath.

For a description of *Dothichiza* anamorph refer to *Sydowia.* Froidevaux (1972) has obtained the anamorph in culture from ascospore isolates for most of the species.

On leaves, branches and cones of Gymnosperms, on branches of woody dicotyledons; common in temperate regions. Barr (1972) has discussed the generic synonyms and segregated the genus into three series based on ascospore septation and shape.

Key to Dothiora species with anamorphs

Asci more than 8 spored 1

Asci 8 or less spored 2

1. Ascocarps transversely 3-5 septate, 15-24 × 4.5-7 μm ..... *D. moravica*

   Ascospores transversely 7 septate, 18-32 × 3.5-10 μm ..... *D. europaea*

2. Ascospores transversely 1-3 septate, elliptic to obovoid, 13-18.5 × 3-5 μm ..... *D. taxicola*

   Ascospores transversely 3-5 septate, ovoid to oblong, 12.5-17.5 × 4-6.5 μm ..... *D. phaeosperma*

   Ascospores transversely 4-6 septate, narrowly obovoid, 20-30 × 5.5-9 μm ..... *D. salicis*

   Ascospores transversely 5-7 septate, fusiform, 25-30 × 6.5-9 μm ..... *D. rhamni-alpinae*

   Ascospores transversely 5-7 septate, fusiform, 16-32 × 6.5-9.5 μm ..... *D. sphaeroides*

   Ascospores transversely 3-8 septate, fusiform, 14-35 × 6-9 μm ..... *D. pyrenophora*

   Ascospores transversely 1-13 septate, fusiform, 22-40 × 3-4.5 μm ..... *D. pruni-padi*

D. europaea Froid., *Nova Hedwigia* **23:** 695, 1972 (Fig. 81).

Anamorph: *Dothichiza* sp.

Froidevaux (1972) mentions *D. alnicola* Petrak as the possible anamorph.

Stromata gregarious, immersed to erumpent, oblong with several uniseriate locules. Asci many spored, 80-140 × 17-29 μm. Ascospores hyaline transversely 7 septate with or without vertical, straight to oblique septa in some of the cells, constricted at the middle, 18-32 × 3.5-10 μm.

Conidial stroma similar to ascostroma. Conidia ovoid to oblong, hyaline, one celled, 3-9.5 × 2.5-4.5 μm formed singly on phialidic, obpyriform, simple, smooth conidiogenous cells lining the cavity of the pycnidium. Pycnidia frequently found on host and produced in culture (Froidevaux, 1972).

On dead branches of *Acer, Alnus, Prunus, Rhamnus, Salix.* Europe. Type on *Salix helvetica.*

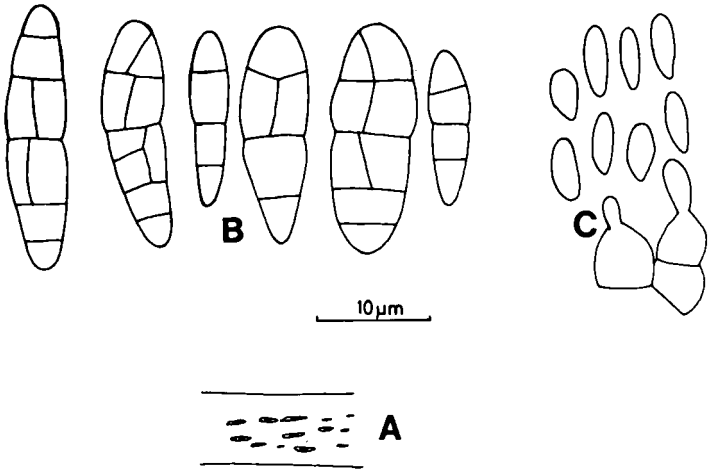


Fig. 81. *Dothiora europaea* (type). A, habit on branch; B, ascospores; C, conidiogenous cells and conidia.

D. moravica (Petrak) Froid., *Nova Hedwigia* **23:** 704, 1972 (Fig. 82).

Keisslerina moravica Petrak, *Annls mycol.* **17:** 74, 1919.
Jaapia triglitziensis Kirschst., *Krypt.-Fl. Mark Brandenb.* **7:** 444, 1938.

Anamorph: *Dothichiza foveolaris* (Fr.) Petrak, *Annls mycol.* **19:** 78, 1921.

Sphaeria foveolaris Fr., *Syst. mycol.* **2:** 499, 1823.
Sphaeropsis foveolaris (Fr.) Fr. *Summa veg. Scand.:* 419, 1849.
Phoma foveolaris (Fr.) Desm., *Ann. Sci. Nat. Bot. ser.* 3, **14:** 113, 1850.
Dothichiza euonymi Bub. & Kab., *Hedwigia* **52:** 357, 1912.
Sclerophoma foveolaris (Fr.) Höhnel, *Hedwigia* **59:** 270, 1917.

Stromata elongate, partly immersed below the epidermis, multilocular. Asci many spored, 80-120 × 18-24 µm. Ascospores hyaline, transversely 3-5 septate, constricted at the middle, fusiform, ends tapered, without or with vertical septa in one or two cells, 15-24 × 4.5-7 µm. Pycnidia formed in culture and found on host. Conidia 4-8 × 2-4 µm.

On *Euonymus europaeus* and *Vaccinium myrtillus*. Europe.

D. phaeosperma Froid., *Nova Hedwigia* **23:** 706, 1972 (Fig. 83).

Anamorph: *Dothichiza* sp. (Froidevaux, 1972).

Stromata sparse, immersed erumpent, oblong, multilocular. Asci 8

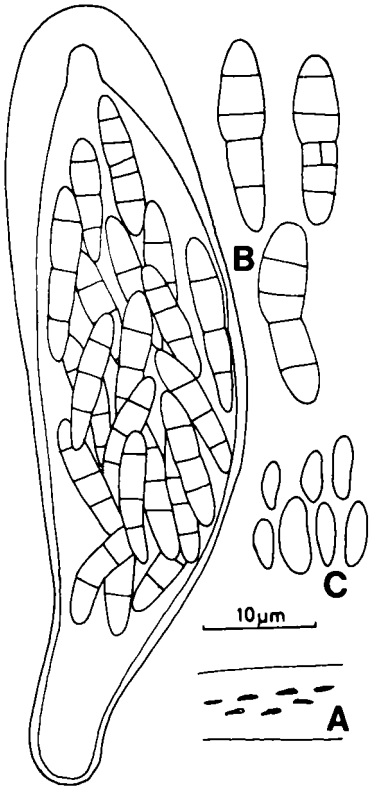


Fig. 82. *Dothiora moravica.* A, habit on branch; B, ascus and ascospores; C, conidia.

spored, 60-95 × 8-13 µm. Ascospores pale brown, transversely 3 (5) septate, constricted at the middle, 12.5-17.5 × 4-6.5 µm, ovoid to oblong.

Pycnidia formed in culture as well as present on host. Conidia hyaline, ovoid to oblong, one celled, 3-9.5 × 2.5-4.5 µm.

On dead branches of *Lonicera coerula.* Switzerland.

D. pruni-padi Froid., *Nova Hedwigia* **23:** 694, 1972 (Fig. 84).

Anamorph: *Dothichiza* sp. (Froidevaux, 1972).

Stromata pulvinate, immersed, erumpent, gregarious, multilocular, non ostiolate. Asci 8 spored, 70-85 × 14-16 µm. Ascospores hyaline, cylin-

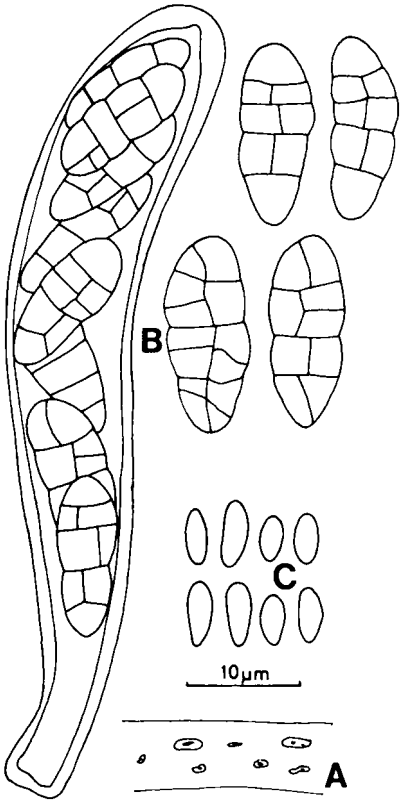


Fig. 83. *Dothiora phaeosperma* (type). A, habit on branch; B, ascus and ascospores; C, conidia.

dric, fusiform, transversely 1-13 septate, slightly constricted at the middle, with 1-4 vertical septa, 22-40 × 3-4.5 µm.

Pycnidia found frequently associated with ascostromata on host and similar to ascostromata. Conidia ovoid to oblong, hyaline, one celled, 3-9.5 × 2.5-4.5 µm.

On dead branches of *Prunus padus*. Switzerland.

D. pyrenophora (Fr.) Fr., *Summa veg. Scand.:* 418, 1849 (Fig. 85).

Dothidea pyrenophora Fr., *Syst. mycol.* **2:** 552, 1823.
Curreyella aucupariae A.L.Sm., *Trans. Br. mycol. Soc.* **3:** 43, 1907.
Dothiora aucupariae (A.L.Sm.) Theiss. & H. Sydow, *Annls mycol.* **13:** 359, 1915.

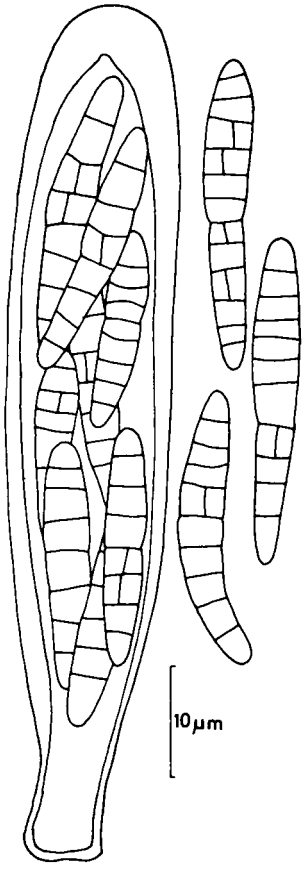


Fig. 84. *Dothiora pruni-padi* (type). Ascus and ascospores.

Anamorph: *Dothichiza sorbi* Lib. in Roum. *Fung. Gall. exs.* No. 627, 1880.

Micropera sorbi Thüm., *Hedwigia* **19:** 189, 1880.
Dothiorella pyrenophora Sacc., *Syll. Fung.* **3:** 238, 1884.
Dothiopsis pyrenophora P. Karsten, *Acta Soc. Faun. Fl. Fenn.* **6:** 15, 1890.
Tylophoma sorbi Kleb., *Phytopath. Z.* **6:** 284, 1933.

Stromata gregarious immersed to erumpent, rounded, elliptic or pulvinate, Asci 8 spored, 40-75 × 10-20 µm. Ascospores fusiform, asymmetrical, hyaline, rarely pale brown, transversely 3-8 septate with vertical septum in all the central cells and rarely in one end cell, 14-35 × 6-9 µm.

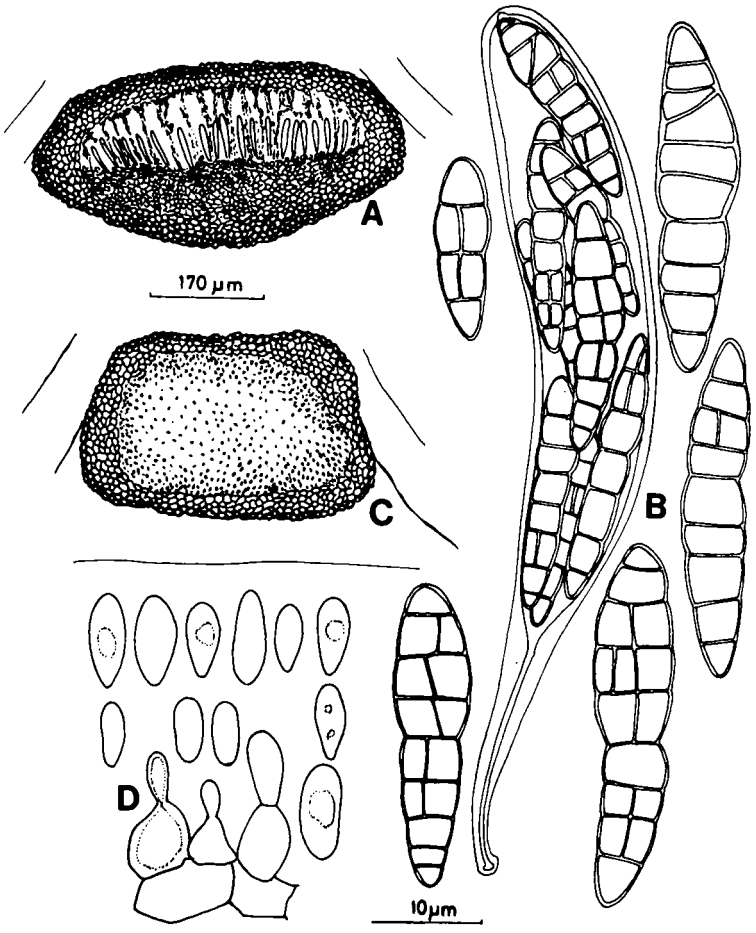


Fig. 85. *Dothiora pyrenophora*. A, v.s. ascostroma; B, ascus and ascospores; C, v.s. pycnidium; D, conidiogenous cells and conidia.

Pycnidia formed in culture and abundant on host. Conidia 4-8 × 2.5-4 µm. On branches of *Sorbus* spp. Europe, N. America.

D. rhamni-alpinae Froid., *Nova Hedwigia* **23:** 702, 1972 (Fig. 86).

Anamorph: *Dothichiza* sp. (Froidevaux, 1972).

Stromata densely gregarious, immersed erumpent, uniseriately multilocular, non ostiolate. Asci 8 spored, 80-110 × 16-19 µm. Ascospores

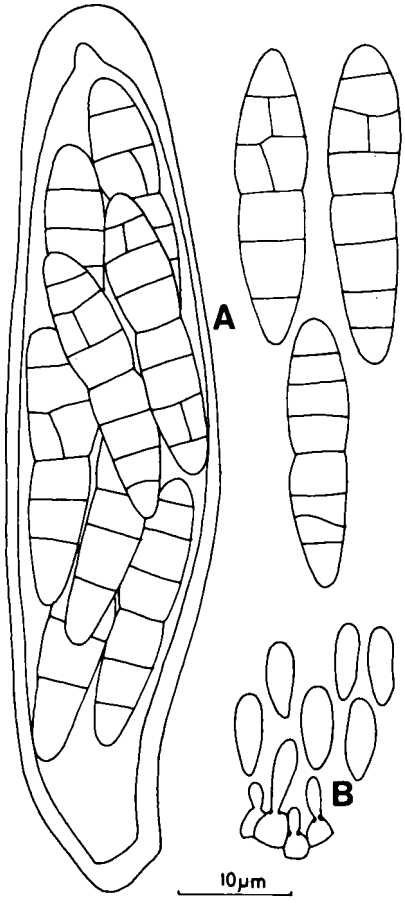


Fig. 86. *Dothiora rhamni-alpinae* (type). A, ascus and ascospores; B, conidiogenous cells and conidia.

hyaline, transversely 5-7 septate, constricted at the middle with 1 or 2 vertical septa in one or two cells, 25-30 × 6.5-9 µm, fusoid.

Pycnidia found on host as well as produced in culture (Froidevaux, 1972), similar to ascostromata. Conidia ovoid to oblong, hyaline, one celled, 3-9.5 × 2.5-4.5 µm.

On dead branches of *Rhamnus alpina*. Italy.

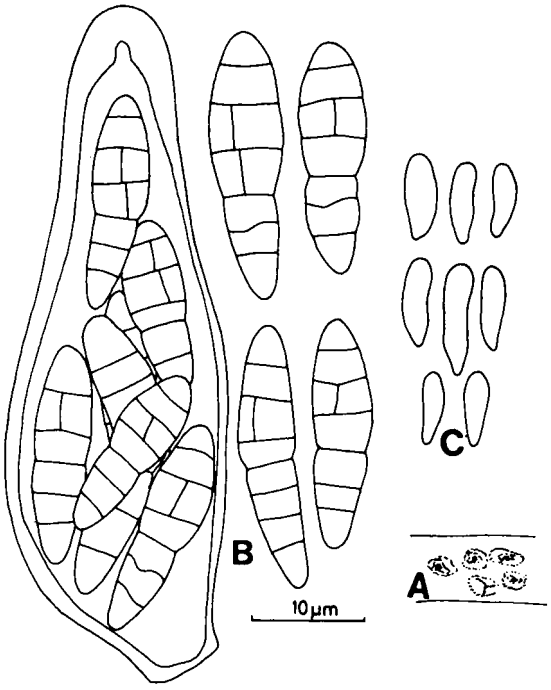


Fig. 87. *Dothiora salicis.* A, habit on branch; B, ascus and ascospores; C, conidia.

D. salicis Vleugel, *Svensk. Bot. Tidskr.* **2:** 374, 1908 (Fig. 87).

Anamorph: *Dothichiza* sp. (According to Froidevaux, 1972).

(Dothiorella pyrenophora (P. Karsten) Sacc. var. *salicis* P. Karsten belongs to this anamorph).

Stromata gregarious, erumpent, lenticular to elongate, multilocular. Asci 8 spored, 80-140 × 12-20 µm. Ascospores hyaline, asymmetrical, transversely 4-6 septate, constricted at the primary septum which is below the middle, with 1 or 2 vertical septa, 20-30 × 5.5-9 µm, narrowly obovoid.

Pycnidia formed in culture (Froidevaux, 1972) as well as found on host. Conidia 4.5-9 × 2.5-3.5 µm.

On branches of *Salix phylicifolia, Salix* spp. Sweden.

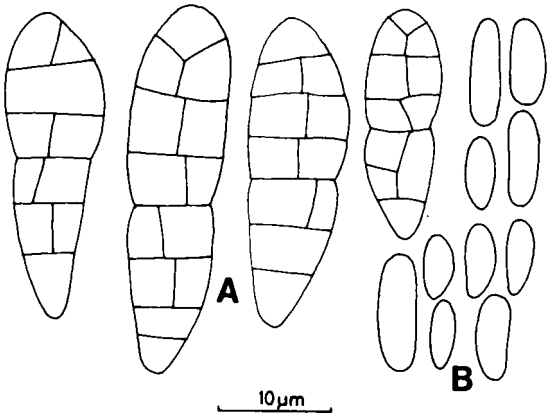


Fig. 88. *Dothiora sphaeroides*. A, ascospores; B, conidia.

D. sphaeroides (Pers.: Fr.) Fr., *Summa veg. Scand.:* 419, 1849 (Fig. 88).

Sclerotium sphaeroides Pers., *Synop. method. Fung. :*125, 1801.
Dothidea sphaeroides Pers.: Fr., *Syst. mycol.* **2:** 552, 1823.

Anamorph: *Dothichiza tremulae* (Sacc.) Höhnel, *Sber. Akad. Wiss. Wien* **125:** 68, 1916.

Phoma tremulae Sacc., *Annls mycol.* **2:** 529, 1904.
Dothiopsis tremulae (Sacc.) Died., *Kryptfl. Mark. Bandenb.* **9:** 238, 1912.

Stromata gregarious, erumpent, elongate, pulvinate, multilocular. Asci 80-100 × 18-20 µm, 8 spored. Ascospores fusiform, 5-7 transversely septate, constricted at the middle, tapering at the base, with vertical septa in most of the cells, 16-32 × 6.5-9.5 µm.

Pycnidia formed in culture (Froidevaux, 1972) and found on host, up to 500 µm broad, immersed. Conidia oblong, hyaline, guttulate, 4-10 × 2.5-3.5 µm.

On branches of *Populus tremula* and *P. tremuloides*. Europe, N. America.

D. taxicola (Peck) Barr, *Contr. Univ. Mich. Herb.* **9:** 575, 1972.

Sphaeria taxicola Peck, *Ann. Rep. N. Y. St. Mus.* **24:** 99, 1872.
Sphaerella taxi Cooke, *Gard. Chron.* **9:** 274; *Grevillea* **6:** 121, 1878.
Leptosphaeria taxicola (Peck) Sacc., *Syll. Fung.* **2:** 85, 1883.

Metasphaeria taxicola (Peck) Peck, *Ann. Rep. N.Y. St. Mus.* **39:** 58, 1886.
Sphaerulina taxicola (Peck) Berl., *Icon. Fung.* **1:** 125, 1894.
Metasphaeria taxi (Cooke) Oudem., *Ned. Kruidk. Arch.* **3**, 2: 170, 1900.
Sphaerulina taxi (Cooke) Massee, *Diseases Cult. Pl.* :220, 1910.
Saccothecium taxicola (Peck) Kirschst., *Krypt.-Fl. Mark Brandenb.* **7:** 427, 1938.

Anamorph: *Dothichiza* sp. (*Cytospora taxicola* Cooke & Massee)

Stromata immersed to erumpent, globose or depressed, epiphyllous, scattered. Asci, 8 spored, 60-96 × 9-14.5 μm. Ascospores hyaline to yellowish, narrowly elliptic or obovoid, tapering to pointed ends, straight to curved, 1-3 septate, not constricted at the septa, 13-18.5 × 3-5 μm.

Pycnidia obtained in culture (Callen, 1938) as well as present on the leaves, immersed, muiltilocular. Conidia hyaline, one celled, 3-5 × 1 μm formed on short conidiogenous cells.

On leaves of *Taxus* spp. Europe, N. America.

GUIGNARDIA Viala & Ravaz, *Bull. Soc. mycol. Fr.* **8:** 63, 1892.

Type sp.: *G. bidwellii* (Ell.) Viala & Ravaz, *Bull. Soc. mycol. Fr.* **8:** 63, 1892.

Anamorphs: *Phyllosticta* Pers. (Punithalingam, 1974; van der Aa, 1973)

Spermatial state: *Leptodothiorella* Höhnel *sensu* Sydow ex van der Aa (1973).

Pseudothecia globose to subglobose, solitary to aggregated as stromatic locules, ostiolate, with or without long necks. The relatively thick-wall is composed of thick-walled, brown, pseudoparenchymatous cells on the outer layer which is somewhat darker around the ostiole and subhyaline to hyaline, thin-walled cells in the inner layers. Asci clavate to cylindrical, stalked, thickened and rounded at the apex, 8 spored. Ascospores one celled, hyaline, straight or slightly curved, ovoid, ellipsoidal or rhomboidal, guttulate, usually wider in the middle and with distinct mucilaginous appendages at one or both ends, not more than 25 μm long. Pseudoparaphysoids absent in mature pseudothecia.

Pycnidia single, globose to pyriform, dark brown, immersed, thick-walled, unilocular, ostiolate with the cells on the outer layer thick-walled and dark brown of textura angularis and the cells of the inner layers thin-walled, hyaline to subhyaline. Conidiogenous cells holo-

blastic, determinate, discrete, hyaline, sometimes rarely integrated, cylindrical to doliiform formed from the cells lining the pycnidial locule. Conidia hyaline, smooth, thin-walled, one celled, globose, ellipsoidal, clavate or obclavate, with an obtuse apex and usually truncate base, enveloped in a thin mucilaginous sheath which persists at maturity and in some species with a single apical mucilaginous, attenuating appendage.

Leptodothiorella spermogonia similar to pycnidia. Spermatia cylindrical to dumb-bell shaped, guttulate, straight or slightly curved formed singly in basipetal succession on holoblastic, filamentous to cylindrical, simple or branched spermatiogenous cells.

Several authors have wrongly classified the spermatial state in *Asteromella.* Like *Botryosphaeria,* species of *Guignardia* can readily be grown in culture.

On Gymnosperms, Monocotyledons and herbaceous Dicotyledons.

Barr (1972) placed *Guignardia* as a synonym of *Botryosphaeria* because of difficulty in separating "intermediates" between *Botryosphaeria* and *Guignardia. Guignardia* is distinguished from *Botryosphaeria* by unilocular pseudothecia, medium sized ascospores usually not exceeding 25 μm long, and by *Phyllosticta* anamorph. Species of *Guignardia* are saprophytes or semiparasites, mostly foliicolous. Many species of *Guignardia* and the *Phyllosticta* anamorph have been correlated by van der Aa (1973) and Punithalingam (1974).

G. aesculi (Peck) Steward, *Phytopathology* **6:** 5, 1916.

Laestadia aesculi Peck, *Rep. N. Y. St. Mus.* **39:** 51, 1885.
Botryosphaeria aesculi (Peck) Barr, *Contr. Univ. Michigan Herb.* **2:** 561, 1972.

Anamorph: *Phyllosticta sphaeropsoidea* Ell. & Ev., *Bull. Torrey bot. Club* **10:** 97, 1883.
Phyllostictina sphaeropsoidea (Ell. & Ev.) Petrak, *Sydowia* **10:** 265, 1957.

Spermatial state: *Leptodothiorella aesculicola* (Sacc.) comb. nov.
Asteromella aesculicola (Sacc.) Petrak, *Sydowia* **10:** 266, 1957.
Phyllosticta aesculicola Sacc., *Michelia* **1:** 134, 1878.

Pseudothecia on dead leaves in spring. Asci 55-70 × 14-18 μm. Ascospores 12-18 × 7-9 μm.

Pycnidia on leaf spots in living leaves in summer and autumn, epi-

phyllous. Conidiogenous cells cylindrical or conical, 5-10 × 2-3.5 μm. Conidia 10-20 × 9-13 μm, surrounded by a mucilaginous sheath, with a short, tongue-shaped, hyaline apical appendage, 6-7.5 μm long on fresh conidia.

Spermatiogenous cells long and slender, 3.5-4 × 1.2 μm. Spermatia oblong cylindrical or dumb-bell shaped, 3-9 × 0.5-2.5 μm.

On *Aesculus,* U.S.A.

G. arachidis Punith., *Mycol. Pap.* **136:** 8, 1974.

Anamorph: *Phyllosticta* sp.

Pseudothecia single to aggregated with long necks. Asci 50-70 × 10-13 μm. Ascospores 14-16 × 5-6 μm with gelatinous apical caps.

Pycnidia stromatic, variable in shape. Conidiogenous cells, simple, cylindrical. Conidia obovoid, 9-12 × 5-6 μm, with a mucilaginous sheath and an apical hyaline appendage 6-11 μm long.

Spermatia cylindrical to dumb-bell shaped, 6-8 × 1 μm.

Isolated from *Arachis hypogaea.* Barbados.

G. bidwellii (Ell.) Viala & Ravaz, *Bull. Soc. mycol. Fr.* **8:** 63, 1892 (Fig. 89).

Sphaeria bidwellii Ell., Bull. Torrey bot. Club **7:** 90, 1880.
Physalospora bidwellii (Ell.) Sacc., *Syll. Fung.* **1:** 441, 1882.
Laestadia bidwellii (Ell.) Viala & Ravaz, *Progresso agric. Vitic.* **9:** 490-493, 1888.
Carlia bidwellii (Ell.) Prunet, *Revue gen. Bot.* **10:** 127, 1898.
Botryosphaeria bidwellii (Ell.) Petrak, *Sydowia* **11:** 440, 1957.

Anamorph: *Phyllosticta ampelicida* (Engleman) van der Aa, *Stud. Mycol.* **5:** 28, 1973.

Naemospora ampelicida Engleman, *Trans. St. Louis Acad. Sci. J. Proc.* **2:** 165, 1861.
Depazea labruscae Engelman, *Trans. St. Louis Acad. Sci. J. Proc.* **3:** 215, 1877.
Phyllosticta viticola Thüm., Die Pilze des Weinstockes :188, 1878.
Phyllosticta labruscae Thüm., l.c.: 189, 1878.
Septoria viticola Berk. & M.A. Curtis in Thüm., l.c.: 188, 1878.
Sacidium viticola Cooke in Thüm., *Mycopath. Univ.* 1393, 1879.
Phyllosticta ampelopsidis Ell. & Martin in Martin, *J. Mycol.* **2:** 14, 1886.

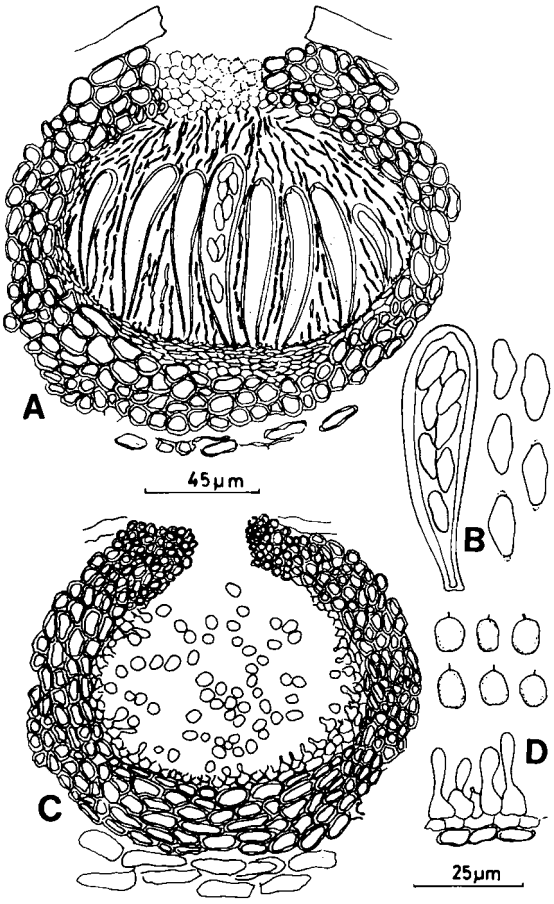


Fig. 89. *Guignardia bidwellii.* A, v.s. pseudothecium; B, ascus and ascospores; C, v.s. pycnidium; D, conidiogenous cells and conidia.

Phyllosticta vulpinae Allesch., *Rabenh. Krypt.-Fl.* 1, **6:** 98, 1898.
Phyllostictina clemensae Petrak, *Annls. mycol.* **26:** 441, 1928.
Phyllostictina viticola (Thüm.) Petrak, *Annls mycol.* **38:** 258, 1940.

Spermatial state: *Leptodothiorella* sp.

Pseudothecia stromatic locules. Asci 45-65 × 9-14 µm. Ascospores ellipsoid or ovoid, 12-17 × 6-7.5 µm.

Pycnidia epiphyllous, unilocular. Conidiogenous cells cylindrical or conical, 6 × 3 µm, Conidia 5-12 ×4-7 µm surrounded by a mucilaginous layer, containing a large number of coarse guttules and a large,

bright central vacuole, with an apical appendage of about the length of the conidium.

Spermatia dumb-bell shaped, one celled, hyaline, 4-7 × 0.5-2 μm.

On leaves, fruits and stems of *Vitis, Ampelopsis* and *Cissus,* causing black rot of grapes and restricted to members of Vitaceae.

Luttrell (1946, 1948) differentiated three formae specialies on host specificity viz. *G. bidwellii* f. *euvitis,* f. *muscadinii* and f. *parthenocissi.*

G. calami (H. & P. Sydow) von Arx & E. Müller, *Beitr. Krypt-fl. Schweiz* **11:** 55, 1954.

Physalospora calami H. & P. Sydow in H. & P. Sydow & Butler, *Annls. mycol.* **9:** 407, 1911.
Physalospora arecae Höhnel, *Sber Akad. Wiss. Wien* **121:** 383, 1912.
Guignardia arecae Sacc., *Atti Acad. sci. venet-trent-istriana* **10:** 63, 1917.
Melanops calami Petrak, *Annls mycol.* **32:** 375, 1934.
Melanops banosensis Petrak, *Annls mycol.* **32:** 436, 1934.
Guignardia banosensis (Petrak) von Arx & E. Müller, *Beitr. Krypt-fl. Schweiz* **11:** 57, 1954.

Anamorph: *Phyllosticta arecae* Höhnel, *Sber. Akad. Wiss. Wien* **121:** 385, 1912.

Phyllostictina banosensis Petrak, *Annls mycol.* **32:** 437, 1934.
Phyllostictina arecae (Höhnel) Petrak & Sydow in Petrak, *Annls mycol.* **32:** 376, 1934.
Phyllosticta arecae Died. in H. & P. Sydow & Butler, *Annls mycol.* **14:** 185, 1916.
Phyllostictina arecae (Died.) Petrak & H. Sydow. *Beih. Rep. spec. nov. regni. veg.* **42:** 188, 1927.

Pseudothecia develop often in association with the conidial state, immersed, erumpent. Asci 40-70 × 12-18 μm. Ascospores 12-18 × 5-9 μm.

Pycnidia epiphyllous, unilocular. Conidiogenous cells short cylindrical or conical, 5-12 × 1.5-3 μm. Conidia surrounded by a thick mucilaginous layer, containing a dense mass of coarse, greenish guttules and often a large, bright vacuole, with a distinct apical appendage, 3-10 μm long, slightly tapering and disappearing on older conidia.

On *Areca, Calamus, Caryota* (Palmaceae). Asia.

G. capsici Punith., *Mycol Pap.* **136:** 13, 1974.

Anamorph: *Phyllosticta* sp.

Pseudothecia solitary to aggregated, with long necks. Asci 50-75 × 10-13 μm. Ascospores 11-13 × 4-5 μm with mucilaginous apical caps.

Pycnidia aggregated to solitary, stromatic, variable in shape. Conidiogenous cells, pyriform to cylindrical. Conidia 9-12 × 3-5 μm surrounded by a mucilaginous sheath with a hyaline apical appendage, 6-10 μm long. Spermogonia not seen.

Isolated from fruits of *Capsicum frutescens*. Hong Kong.

G. citricarpa Kiely, *Proc. Linn. Soc. N.S.W.* **73:** 259, 1948.

Anamorph: *Phyllostica citricarpa* (McAlp.) van der Aa, *Stud. Mycol.* **5:** 40, 1973.

Phoma citricarpa McAlpine, *Diseases of Citrus in Australia:* 21 & 81, 1899.
Phyllostictina citricarpa (McAlp.) Petrak, *Sydowia* **7:** 115, 1953.

Pseudothecia on decaying leaves. Ascospores hyaline, guttulate, 8-17.5 × 3.5-8 μm with a gelatinous cap at each end.

Pycnidia on leaves, petioles, twigs and fruits. Conidiogenous cells cylindrical, 4-8 × 2-3.5 μm. Conidia 6-13 × 5-9 μm surrounded by a thick mucilaginous sheath, containing coarse guttules, with an apical appendage 5-15 μm long, very caducous.

Spermatia produced on elongated, cylindrical spermatiogenous cells, dumb-bell shaped, sometimes cylindrical, straight or curved 5-8 × 0.5-1 μm.

On *Citrus*. Widespread in countries where this crop is grown.

G. cocoicola Punith., *Mycol. Pap.* **136:** 15, 1974.

Anamorph: *Phyllosticta cocoicola* (Batista) comb. nov.
Phyllostictina cocoicola Batista, *Bolm. Secr. Agric. Ind. Com. Est. Pernambuco* **19:** 214, 1952.

Pseudothecia solitary to aggregated, with long necks. Asci 60-70 × 11-13 μm. Ascospores 18-16 × 4-7 μm with hyaline apical caps.

Pycnidia solitary to aggregated, variable in shape. Conidiogenous cells pyriform to cylindrical. Conidia 10-16 × 5-6 μm surrounded by a mucilaginous sheath with an apical appendage 6-10 μm long. Spermogonia not observed.

Isolated from pinnae of Coconut *(Cocos nucifera)* Malaysia (Sabah).

G. concinna (H. Sydow) Van der Aa, *Stud. Mycol.* **5:** 49, 1973.

Melanops concinna H. Sydow, *Annls mycol.* **24:** 373, 1926.

Anamorph: *Phyllosticta concinna* (H. Sydow) Van der Aa, *Stud. Mycol.* **5:** 49, 1973.

Phyllostictina concinna H. Sydow, *Annls mycol.* **24:** 406, 1926.
Caudophoma ehretiae Patel & Thirum., *Sydowia* **20:** 36, (1966) 1968.
Phyllostictina ehretiae (Patel & Thirum.) Petrak, *Sydowia* **21:** 241, (1966) 1968.

Spermatial state: *Leptodothiorella concinna* H. Sydow, *Annls mycol.* **24:** 407, 1926.

Pseudothecia on necrotic parts of living leaves. Asci 50-80 × 18-24 μm. Ascospores 14-20 × 7.5-10 μm, with a hyaline slime cap at the base.

Pycnidia epiphyllous. Stroma well developed. Conidiogenous cells short cylindrical, 6-10 × 1.5-2.5 μm. Conidia 12-20 × 7-10 μm, surrounded by a thick mucilaginous sheath, containing numerous greenish granules and often a large bright vacuole, with small apical appendage. Appressoria brown, one celled, globose, pyriform or clavate, 13-22 × 7-15 μm.

Spermatiogenous cells 8-22 × 1-1.5 μm. Spermatia formed in chains, one celled, hyaline, elongated cylindrical or dumb-bell shaped, biguttulate, 6-9 × 1-1.5 μm.

On *Cordia* and *Ehretia*. Costa Rica, India.

G. dioscoreae (Petrak) Pande, *Sydowia* **22:** 367, (1968) 1969.

Discosphaerina dioscoreae Petrak, *Annls mycol.* **29:** 201, 1931.
Guignardia dioscoreae Saw. ex Katumoto, *J. Jap. Bot.* **40:** 193, 1965.

Anamorph: *Phyllosticta dioscoreae* Cooke, *Grevillea* **6:** 136, 1878.

Phyllostictina dioscoreae (Cooke) Petrak, *Annls mycol.* **38:** 255, 1940.
Septoria dioscoreae Cooke, Hedwigia **17:** 38, 1878.
Phyllosticta dioscoreacearum Baccarini, *Nuovo G. bot. Ital.* **12:** 697, 1905.
Phyllosticta graffiana Sacc., *Annls mycol.* **11:** 316, 1913.

Pseudothecia on necrotic parts of living leaves. Asci 32-55 × 9-15 μm. Ascospores 8-16 × 4-9 μm, often with a hyaline slime cap at one or either end.

Pycnidia epiphyllous, loosely scattered over spots. Stroma present. Conidiogenous cells cylindrical, 4-11 × 1.5-3 μm. Conidia 6-9 × 5-7 μm surrounded by a thick mucilaginous sheath, containing numerous coarse guttules, with an apical appendage 3-6 μm long.

On *Dioscorea*. China, Formosa, India, Philippines, U.S.A.

G. eupatorii Punith., *Mycol. Pap.* **136:** 21, 1974.

Anamorph: *Phyllosticta* sp.

Pseudothecia solitary or in groups, with long necks. Asci 65-100 × 12-13 μm. Ascospores 14-16 × 5-6 μm with rounded ends and hyaline apical caps.

Pycnidia solitary or grouped. Conidiogenous cells cylindrical to pyriform. Conidia 10-13 × 6-8 μm surrounded by a mucilaginous sheath with an apical appendage 4-8 μm long. Spermogonia not observed.

Isolated from *Eupatorium*. Sri Lanka.

G. gaultheriae van der Aa, *Stud. Mycol.* **5:** 56, 1973.

Anamorph: *Phyllosticta gaultheriae* Ell. & Ev., *J. Mycol.* **1:** 153, 1885.
Phyllosticta gaultheriae Ell. & Ev. f. *shallon* Dearn., *Mycologia* **16:** 159, 1924.

Spermatial state: *Leptodothiorella* sp.

Pseudothecia on dead leaves. Asci 35-90 × 15-24 μm. Ascospores 14-16 × 4.5-7 μm surrounded by a mucilaginous sheath.

Pycnidia on leaf spots on living leaves, epiphyllous. Conidiogenous cells short cylindrical, caducous, 4-12 × 1.5-2.5 μm. Conidia 4-9 × 4-7 μm, surrounded by a thick mucilaginous sheath, with an apical appendage 2-6 μm long present on fresh conidia. Appressoria olivaceous brown, globose or clavate, one celled, seldom 1-2 septate.

Spermatiogenous cells long, slender, 4-15 × 1-2.5 μm. Spermatia cylindrical or dumb-bell shaped, straight or slightly curved, swollen guttulate, 4-9 × 1-2.5 μm.

On *Gaultheria*. U.S.A.

G. heveae H. & P. Sydow, *Annls mycol.* **14:** 360, 1916.

Guignardia heveae Fragoso & Cif., *Boln R. Soc. esp. Hist. nat.* **26:** 492, 1926.
Guignardia heveicola Cif., *Atti Ist. bot. Univ. Lab. critt. Pavia* **19:** 133, 1962.

Anamorph: *Phyllosticta* sp.

Pseudothecia solitary or in groups in extensive stromata, with long necks. Asci 60-80 × 10-13 μm. Ascospores 14-16 × 5-6 μm with rounded ends and hyaline apical mucilaginous caps.

Pycnidia variable in shape, single to rarely aggregated. Conidiogenous cells holoblastic, simple, slightly obpyriform, hyaline. Conidia 8-10 × 5-6 μm, surrounded by a mucilaginous sheath with a hyaline apical appendage, 4-9 μm long.

Spermogonia sparse. Spermatia dumb-bell shaped, one celled, hyaline, 4-5 × 1 μm.

On *Hevea*. Burma, Dominican Republic, Philippines.

G. mangiferae Roy, *Ind. Phytopath.* **20:** 348, 1958.

Anamorph: *Phyllosticta arundinacearum* van der Aa, *Stud. Mycol.* **5:** 31, 1973.

Phyllostictina mangiferae Batista & Vital, *Bolm Secr. Agric. Ind. Com. Est. Pernambuco* **19:** 214, 1952.

Pseudothecia solitary, subglobose with long necks. Asci 50-65 × 10-12 μm. Ascospores 12-13 × 4-5 μm with rounded ends and hyaline mucilaginous apical caps.

Pycnidia sparse, solitary, globose. Conidiogenous cells cylindric to obpyriform. Conidia obovoid, hyaline, guttulate, 8-10 × 4-5 μm, usually surrounded by a mucilaginous sheath with a hyaline apical appendage, 5-8 μm long. Spermogonia not observed.

Isolated from leaves of mango (*Mangifera indica*). India, Malaysia.

G. morindae (Koorders) van der Aa, *Stud. Mycol.* **5:** 69, 1973.

Physalospora morindae Koorders, *Verh. K. med. Akad. Wet.* 2, **13:** 190, 1907.

Anamorph: *Phyllosticta morindae* (Petrak & H. Sydow) van der Aa, *Stud. Mycol.* **5:** 69, 1973.

Phyllostictina morindae Petrak & H. Sydow, *Beih. Rep. spec. nov. regni veg.* **42:** 200, 1927.

Spermatial state: *Leptodothiorella* sp.

Asci 40-60 × 8-12 μm. Ascospores 11-13 × 4-5 μm.

Pycnidia in yellow, grey to black leaf spots, epiphyllous. Conidiogenous cells short cylindrical to conical, 4-9 × 2-3 μm. Conidia 7-10 ×

4-6 μm surrounded by a thick mucilaginous sheath, with a stiff apical appendage, 4-7.5 μm long.

Spermatiogenous cells long, slender, 5-20 × 1-1.5 μm. Spermatia cylindrical or dumb-bell shaped, biguttulate, 6-8 × 1.5-2 μm.

On *Morinda citrifolia*. Indonesia, (Java).

G. musae Racib., *Bull. Acad. Sci. Cracovie* **3:** 388, 1909.

Guignardia musae Stevens, *Bull. Bernice P. Bishop Mus. Honolulu* **19:** 101, 1925.
Phomatospora musae Yen, *Bull. Soc. mycol. Fr.* **88:** 224, 1962.

Anamorph: *Phyllosticta musarum* (Cooke) van der Aa, *Stud. Mycol.* **5:** 72, 1973.

Sphaeropsis musarum Cooke, *Grevillea* **8:** 93, 1880.
Phoma musae Sacc., *Syll. Fung.* **3:** 163, 1884.
Macrophoma musae (Sacc.) Berk. & Vogl., *Atti Soc. Venet.-trent. Sci. nat.* **1886:** 187, 1886.
Phoma musae Carpenter, *Rep. Hawaii agric. Exp. Stn.* **1918:** 39, 1919.
Phyllostictina musarum (Cooke) Petrak, *Annls mycol.* **29:** 268, 1931.

Asci 50-85 × 8-15 μm. Ascospores 13-20 × 4-8 μm.

Pycnidia in spots on leaves and fruits. Stroma present. Conidiogenous cells, obpyriform to cylindrical, 4-11 × 2-2.5 μm. Conidia 8-20 × 4-8 μm, with mucilaginous sheath and a hyaline apical appendage. Spermatia cylindrical to dumb-bell shaped, one celled, 4-7 × 0.5-1 μm.

On *Musa*. Brunei, Burma, Fiji, Hong Kong, India, Indonesia, Indo-China, New Caledonia, New Zealand, Philippines, Samoa, Sri Lanka, West Irian, U.S.A(Hawaii).

G. perseae Punith., *Mycol. Pap.* **136:** 43, 1974.

Anamorph: *Phyllosticta persearum* Batista & Vital, *Bolm. Sacr. Agric. Ind. Con. Est. Pernambuco* **19:** 45, 1952.

Pseudothecia globose to cylindrical with long necks. Asci 50-70 × 10-12 μm. Ascospores 13-16 × 4-7 μm with rounded ends and hyaline mucilaginous apical caps.

Pycnidia solitary or densely grouped. Conidiogenous cells cylindrical. Conidia 8-10 × 4-5 μm, surrounded by a hyaline mucilaginous sheath with a hyaline apical appendage 5-10 μm long. Spermogonia not observed.

Isolated from *Persea americana*. Sabah, Malaysia.

G. philoprina (Berk. & M.A. Curtis) van der Aa, *Stud. Mycol.* **5:** 44, 1973.

Sphaeria philoprina Berk. & M.A. Curtis, *North Am. Fungi* No. 917, 1859.
(for further synonyms refer to van der Aa, 1973)

Anamorph: *Phyllosticta concentrica* Sacc., *Nuovo G. bot. Ital.* **8:** 203, 1876.
(for further synonyms refer to van der Aa, 1973)

Spermatial state: *Leptodothiorella* sp.

Pseudothecia in living and dead leaves. Asci 40-80 × 10-17 μm. Ascospores 14-24 × 5-12 μm with a hyaline, rounded or conical slime cap.

Pycnidia amphigenous, mostly epiphyllous. Conidiogenous cells cylindrical or conical, 4-20 × 1.5-4 μm. Conidia 8-20 × 4-14 μm surrounded by a thick mucilaginous sheath up to 35 μm long from the ends of the conidium. Appressoria clavate, straight or curved, yellowish brown to dark-brown, one celled or 1-2 septate.

Spermatiogenous cells long, slender, 4-35 × 1-2 μm densely lining the cavity; spermatia cylindrical or dumb-bell shaped, 6-15 × 1.5-3 μm, exuding in clear tendrils.

On *Hedera, Heptapleurum, Ilex, Magnolia, Rhododendron* and *Taxus*. Europe, India, U.S.A.

G. pini Sivan., *Trans. Br. mycol. Soc.* **73:** 169, 1979.

Anamorph: *Phyllosticta* sp.

Pseudothecia subepidermal, up to 115 μm broad. Asci 40-75 × 10-13 μm. Ascospores 12-14 × 5-6 μm.

Conidia ovoid to ellipsoid, rarely pyriform or globose, 6-9 × 5-6 μm, surrounded by a thin slime layer and with a faintly visible apical appendage.

On *Pinus*. Malaysia, South Africa, Tanzania.

G. reticulata (DC.: Fr.) van der Aa, *Stud. Mycol.* **5:** 23, 1973.

Sphaeria reticulata DC., *Fl. fr.* **4:** 138, 1815.
Dothidea reticulata DC. Fr., *Syst. mycol.* **2:** 560, 1823.

Asterina reticulata (DC.: Fr.) Chev., *Fl. gen. Envir. Paris* **1:** 447, 1826.
Melanops cruenta Petrak, *Annls mycol.* **25:** 226, 1927.
Botryosphaeria reticulata (DC.: Fr.) Petrak, *Sydowia* **16:** 166, 1962.

Anamorph: *Phyllosticta cruenta* (Kunze) Kickx, *Mem. Acad. Sci. Lett. Arts Belge* **23:** 22, 1849.

Spermatial state: *Leptodothiorella* sp.

Asci 40-60 × 12-18 μm. Ascospores 14-18 × 6-8 μm.

Pycnidia epiphyllous, single, unilocular. Conidiogenous cells cylindrical or conical, 7-12 × 2-4 μm. Conidia 12-21 × 5-10 μm, surrounded by a thin mucilaginous sheath, with an apical appendage 4-17 μm long, up to 3 μm wide at the base tapering towards the tip. Germ tubes occasionally subglobose or irregularly lobed, sometimes 1-4 septate, thick-walled appressoria.

Spermatiogenous cells long, slender, 6-12 × 1-2 μm. Spermatia often in chains, cylindrical or dumb-bell shaped, biguttulate, 4-15 × 1-2 μm.

On *Convallaria, Majanthemum* and *Polygonatum.* Europe.

G. sansevieriae Punith., *Mycol. Pap.* **136:** 45, 1974.

Anamorph: *Phyllosticta* sp.

Pseudothecia simple or in a compressed stroma, with long necks. Asci 60-90 × 15-20 μm. Ascospores 12-15 × 4-5 μm with hyaline mucilaginous apical caps.

Pycnidia stromatic, carbonaceous, ostiolate, with long necks. Conidiogenous cells cylindrical. Conidia 8-12 × 4-6 μm surrounded by a mucilaginous sheath with a hyaline apical appendage 3-6 μm long. Spermogonia not observed.

Isolated from *Sansevieria,* Great Britain.

G. sawadae Kobayashi, *Trans. mycol. Soc. Japan* **16:** 234, 1975.

Anamorph: *Phyllosticta cryptomeriae* Kawamura (as *cryptomae), Bull. Gov. Expt. Stn. Tokyo* **10:** 97, 1913.

Asci 50-63 × 10-15 μm. Ascospores 12.5-20 × 5-7.5 μm.

Conidiogenous cells cylindric to conic. Conidia 9.5-12.5 × 7.5-10.5 μm with a hyaline appendage.

On dead needles of *Cryptomeria japonica,* Japan.

G. vaccinii Shear, *Bull. Torrey bot. Club* **34:** 316, 1907.

Sphaerella andromedae Tracy & Earle, *Bull. Torrey bot. Club* **22:** 176, 1895.
Botryosphaeria vaccinii (Shear) Barr, *Mycologia* **62:** 379, 1970.
Mycosphaerella oxycocci Dearness & House, *Bull. N.Y. St. Mus.* **243-244:** 76, 1923.

Anamorph: *Phyllosticta elongata* Weidemann in Weidemann, Boone & Burdsall, *Mycologia* **74:** 62, 1982.

Asci 60-80 × 9-12 μm. Ascospores 13-17 × 6-7 μm.

Pycnidia on leaf spots, epiphyllous. Conidiogenous cells cylindrical, 5-19 × 2-4 μm. Conidia 8-12 × 5-8 μm surrounded by a mucilaginous sheath, with a hyaline apical appendage up to 17 μm long.

On *Vaccinium*. U.S.A. It was described as the causal fungus of 'blast or blight of flowers and young fruits' or 'early rot of fruits in storage' of cranberries.

LEPTOGUIGNARDIA E. Müller, *Sydowia* **9:** 216, 1955.

The genus is monotypic.

L. onobrychidis E. Müller, *Sydowia* **9:** 217, 1955 (Fig. 90).

Anamorph: *Diplodina* sp. (*Dothichiza*-like, von Arx & Müller, 1975).

Pseudothecia separate, scattered, subepidermal, globose to depressed, with somewhat flattened or papillate apex, ostiolate, 150-200 μm broad. The wall 15-20 μm wide is composed of brown, thick-walled, parenchymatic, 4-10 μm wide, polygonal cells which become more thick-walled at the ostiolar region. Asci clavate, 8 spored, 60-70 × 13-15 μm. Ascospores hyaline, ellipsoidal, two septate with septa near either end cutting off two small end cells and a large central cell, 14-22 × 5-6 μm. Pseudoparaphysoids hyaline, disintegrating.

Pycnidia associated with pseudothecia in the same material, upto 200 μm broad, ostiolate. Conidiogenous cells obpyriform, simple, hyaline, enteroblastic, arising from the cells lining the pycnidial cavity. Conidia obclavate, septate in the middle, 14-17 × 2.5-4 μm, hyaline, with a broader lower cell and an upper narrower cell.

The connection between the two states has yet to be proved by ascospore cultures and is only based on the common occurrence of the two states together on the same material.

On dead stems of *Onobrychis montana*. France.

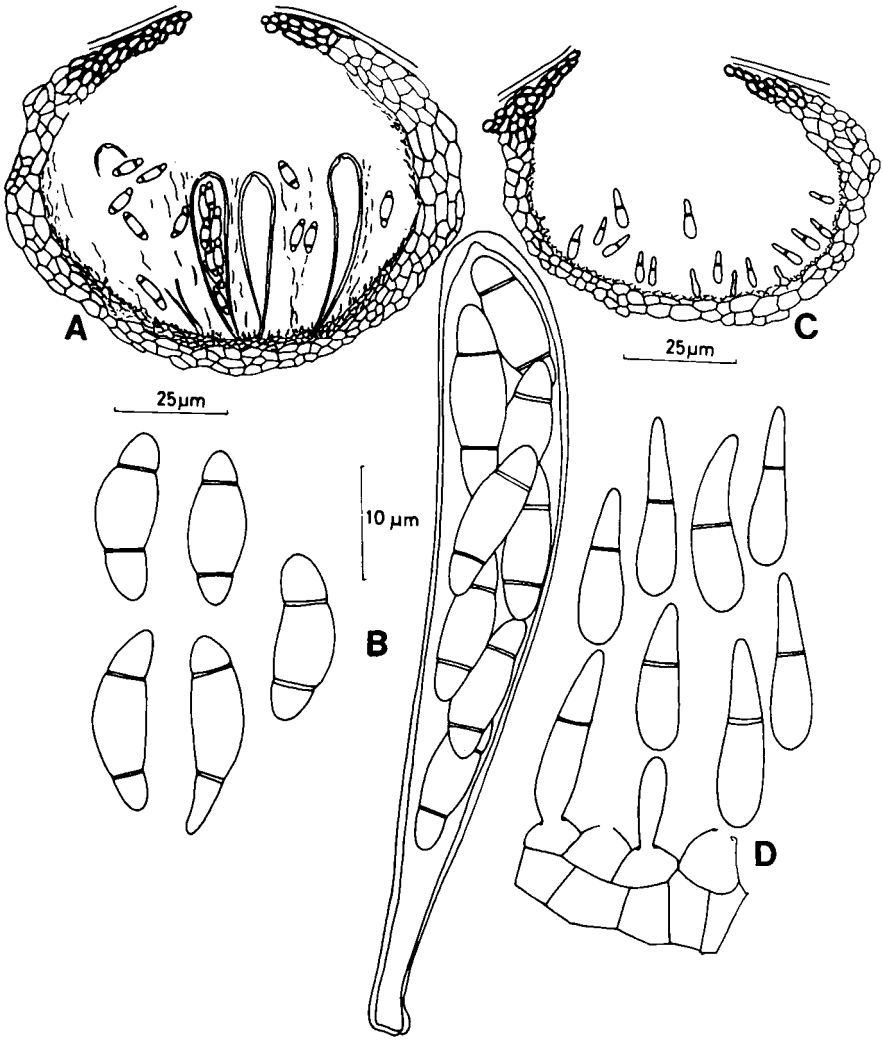


Fig. 90. *Leptoguignardia onobrychidis* (type). A, v.s. ascocarp; B, ascus and ascospores; C, v.s. pycnidium; D, conidiogenous cells and conidia.

MELANODOTHIS R.H. Arnold, *Can. J. Bot.* **49**: 2188, 1972 (1971).

This is a monotypic genus.

M. caricis R.H. Arnold, *Can. J. Bot.* **49:** 2188, 1972 (Fig. 91).

Anamorph: *Ramularia*-like conidia and ovoid blastoconidia formed in culture.

Ascostromata arising from a hypostroma formed within the ovary and perigynum, black, subglobose, multilocular, up to 4 mm broad. The wall is composed of a textura angularis with oblong to rounded pseudoparenchymatic cells which become more thickened, darker and compressed towards the outside. Locules in a single layer beneath the surface of the stroma, each with an ostiole. Asci oblong to rarely oblong-pyriform, aparaphysate, sessile, 8 spored, 30-50 × 5.5-11 μm, arising from a basal cushion of thin-walled, small, pseudoparenchymatic cells. Ascospores hyaline, one celled, thick-walled, narrowly ellipsoidal, 9-14.5 × 2-4 μm, with ends sometimes narrowly and abruptly tapered.

Macroconidia (*Ramularia*-like) formed on indeterminate conidiophores 80-100 μm long and 4-5 μm thick. Conidiogenous cells holoblastic. Conidia hyaline, smooth, catenulate, cylindrical, one celled or 1 septate, branched or unbranched, 30-51 × 3-4.5 μm with a disc-like swelling at each end at separation points. Ovoid blastoconidia formed singly at the apex of hyphae in the periphery of the colony, one celled, hyaline, smooth, 8-15 × 2-3 μm, may also be formed on the long cylindrical conidia as secondary conidia.

In the early stage of the development of ascostromata, micro-conidial locules are formed in the ascostromata. Micro-conidia (spermatia) narrowly oblong, hyaline, 2-3 × 0.5 μm, formed on short projections on the hyaline cells lining the microconidial cavity.

Parasitic on ovaries of *Carex* spp. Canada, China, Japan, New Guinea and U.S.A. (Alaska).

In the stromata it is quite like that of *Rhizogene* H. & P. Sydow but differs from it in the shape and septation of the ascospores and in the pigmentation of the stromata. It is closely related to the other members of the Dothideales like *Dothidea, Mycosphaerella, Microcyclus* etc.

Arnold (1971) has illustrated and fully described the structure, development, cultural characteristics and taxonomy of this species.

MICROCYCLUS Sacc. ex H. & P. Sydow, *Annls. mycol.* **2:** 165, 1904.

Lizoniella Henn. ex P. & D. Sacc., *Syll. Fung.* **17:** 661, 1905.
Pseudosphaerella Höhnel, *Sber. Akad. Wiss. Wien* **120:** 425, 1911.
Diplochora H. & P. Sydow, *Annls mycol.* **11:** 60, 1913, non Höhnel, 1906.
Melanopsammopsis Stahel, *Meded. Dept. Landb. Suriname* **1:** [2], 1915 (sero.)
(Generic synonyms after Müller & von Arx, 1962).

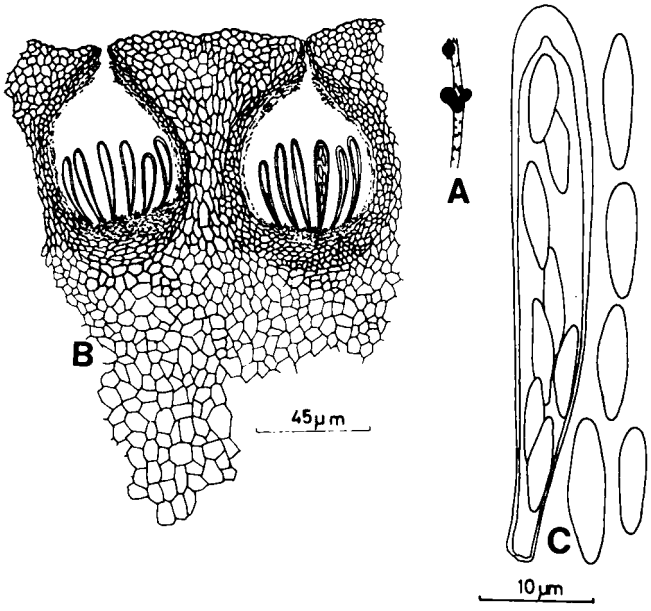


Fig. 91. *Melanodothis caricis* (type). A, ascostromata on *Carex* florets (habit); B, v.s. ascostroma; C, ascus and ascospores.

Type sp.: *M. angolensis* Sacc. ex H. & P. Sydow, *Annls mycol.* **2:** 165, 1904.

Anamorphs: *Fusicladium* Bonorden and *Pazschkeella* H. & P. Sydow.

Ascostromata variable, pulvinate, crust-like or knob-shaped developing on a basally to centrally attached tapered foot-like hypostroma on leaves, rarely on petioles, erumpent to superficial, multilocular with each locule provided with an apical papillate ostiole. The stroma is composed of irregularly rounded to angular, thick-walled, dark brown cells forming a textura angularis or prismatica and the cells of the hypostroma are usually elongated, compressed, or they may form a hyphal mat in the mesophyll tissue. Asci thick-walled, 8 spored, clavate to clavate-cylindric. Ascospores 1 septate usually slightly unequally or rarely in the middle, not or slightly constricted at the septum, mostly hyaline, rarely very pale brown, sometimes mature ascospores may become up to 3 septate. Pseudoparaphysoids filiform, hyaline, usually disappearing in mature stromata.

About eighteen species, some parasitic (Müller & von Arx, 1962; Sivanesan, 1970b, 1975). Only two species are known with anamorphs and they are described below. Anahosur (1971) has described a spermogonial state for *Microcyclus indicus* Tilak.

Key to species of Microcyclus with anamorphs

Ascospores 12-20 × 2-5 μm, anamorph *Fusicladium*..... *M. ulei*

Ascospores 17-24 × 4-7.5 μm, anamorph *Pazschkeella*..... *M. tinctorius*

M. tinctorius (Tul.) von Arx in E. Müller & v. Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 370, 1962 (Fig. 92). (as '*tinctoria*').

Dothidea tinctoria Tul., *Ann. Sci. Nat. Bot. sér.* 4, **9:** 49, 1858.
Dothidella hieronymi Speg., *An. Soc. Cient. Argent.* **12:** 185, 1881.
Dothidella tinctoria (Tul.) Sacc., *Syll. Fung.* **2:** 627, 1883.
Dothidella axillaris Höhnel, *Sber. Akad. Wiss. Wien* **119:** 425, 1910.
Phyllachora berkeleyana Cooke, *Grevillea* **13:** 65, 1884.
Dothidella berkeleyana (Cooke) Berl. & Vogl., *Syll. Fung.* **9:** 1036, 1891.
Dothidella caaguazuensis Speg., *An. Soc. Cient. Argent.* **19:** 250, 1885.
Dothidella lilloana Speg., *An. Mus. nac. Buenos Aires* **6:** 296, 1899.
Lizonia baccharidis Rehm, *Hedwigia* **40:** 104, 1901.
Phaeodothis caaguazuensis (Speg.) H. & P. Sydow, *Annls. mycol.* **2:** 166, 1904.
Dothidella baccharidis Höhnel, *Sber. Akad. Wiss. Wien* **119:** 425, 1910.
Pseudosphaerella baccharidis (Rehm) Höhnel, *Sber. Akad. Wiss. Wien* **120:** 425, 1911.
Plowrightia hieronymi (Speg.) Speg., *Rev. Mus. La Plata* **15:** 27, 1908.

Anamorph: *Pazschkeella brasiliensis* H. & P. Sydow, *Bull. Herb. Boiss.* **1:** 83, 1901.

Ascochyta baccharidis Pat., *Bull. Soc. mycol. Fr.* **8:** 135, 1892.
Clypeodiplodina baccharidis F. Stev., *Mycologia* **19:** 235, 1927.

Ascostromata variable, pulvinate, mostly epiphyllous, also on petioles, up to 1.2 mm broad. Locules up to 100 μm wide. Asci 50-86 × 12-17 μm. Ascospores hyaline, constricted at the septa, ends rounded, 17-24 × 4-7.5 μm.

Pycnidial stroma unilocular to multilocular epiphyllous, gregarious to confluent, subglobose, up to 1000 μm wide, separate or mixed with young ascostromata. Conidiogenous cells simple, phialidic, enteroblastic, determinate, discrete, ampulliform, hyaline, smooth. Conidia hyaline, 1 septate, thick walled, truncate at the base, apex obtuse, smooth, straight or curved, fusoid, 24-48 × 7-10 μm.

On *Baccharis* spp. North and South America.

M. ulei (Henn.) von Arx in E. Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 323, 1962 (Fig. 93).

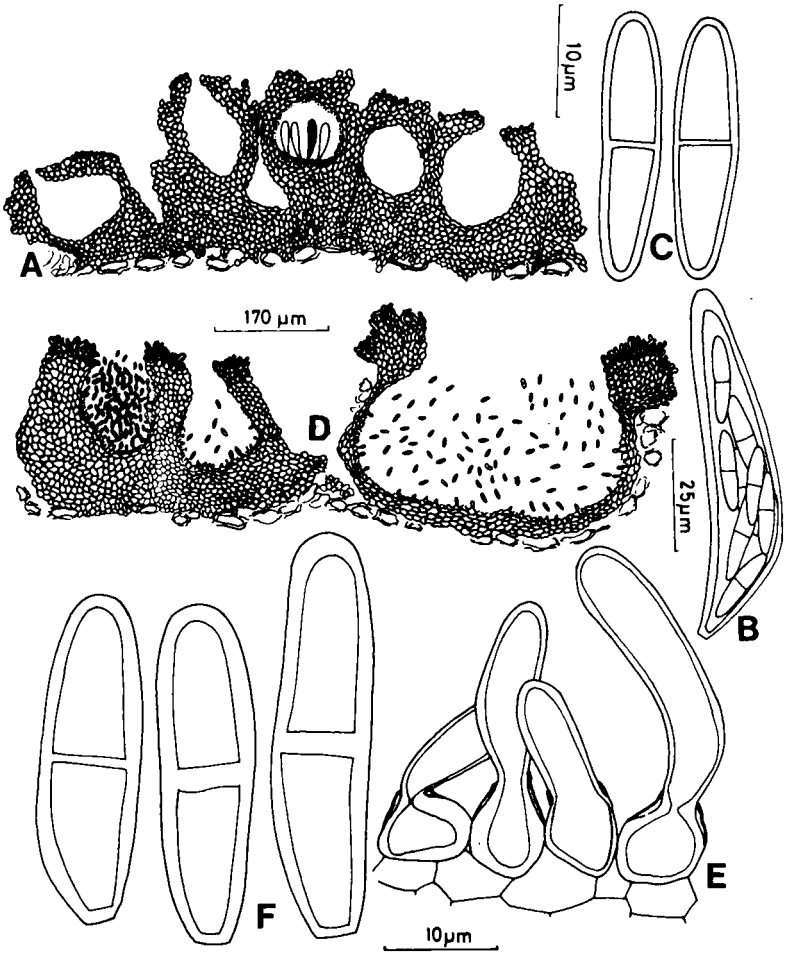


Fig. 92. *Microcyclus tinctorius*. A, v.s. ascostroma; B, ascus; C, ascospores; D, v.s. conidiomata; E, conidiogenous cells; F, conidia.

Dothidella ulei Henn., *Hedwigia* **43:** 242, 1904.
Melanopsammopsis ulei (Henn.) Stahel, *Bull. Dept. Landb. Suriname* **34:** 34, 1917.

Anamorph: *Fusicladium macrosporum* Kuijper, *Bull. Dept. Landb. Suriname* **28:** 6, 1912.

Scolecotrichum heveae Vicens, *Bull. Soc. Path. veg. Fr.* **2:** 17, 1915.
Passalora heveae Massee *sensu* Stahel, *Bull. Dept. Landb. Suriname* **34:** 34, 1917.

Spermogonial state: *Aposphaeria ulei* Henn., *Hedwigia* **43:** 385, 1904.

Ascostromata globose, adaxial, superficial, often crowded, sometimes in rings around the edges of the shot-hole, up to 250 μm broad, frequently fused laterally. Asci clavate, 50-80 × 12-16 μm. Ascospores one septate, hyaline, constricted at the septum, cells unequal with the lower longer, 12-20 × 2-5 μm.

Fusicladium colonies effuse, greyish, powdery. Stromata subepidermal. Mycelium immersed. Conidiophores arising from the stromata, straight to flexuous, sometimes geniculate, pale olivaceous brown, cicatrized, with 1-4 scars, up to 140 μm long, 3-7 μm thick, sometimes swollen at the base. Conidia sometimes straight, often flexuous and curiously twisted, mostly obclavate, truncate at the base, 1 septate, hyaline to pale olivaceous brown, smooth to minutely verruculose, 25-65 × 7-10 μm thick at the broadest part, 2.5-4 μm wide at the scar.

Aposphaeria spermogonia similar but smaller than ascostromata, up to 160 μm broad, ostiolate. Spermatia hyaline, one celled, dumb-bell shaped, minute, borne on hyphal structures.

On *Hevea* spp. Causes the South American leaf blight of Para rubber, one of the most destructive diseases of rubber and a disease limiting the development of a natural rubber industry in America (Holliday, 1970). Symptoms typically on leaves, but also on green stems, petioles, inflorescence and young fruits, beginning with the *Fusicladium* state followed by the ascostromata state. The fungus is restricted to tropical, South and Central America, including the Sao Paulo area of Brazil and Trinidad.

MYCOSPHAERELLA Johanson, *Ofvers. Förh. Kongl. Svenska Vetensk.-Akad.* No. 9, **41:** 163, 1884.

Sphaeria Sect. *Sphaerella* Fr., *Summa veg. Scand.:* 395, 1894, non *Sphaerella* Sommerf. (1824).
Sphaerella (Fr.) Rabenh., *Herb. Viv. Mycol.* ed. 2, No. 264, 1856.
Hypomycopsis Henn., *Hedwigia* **43:** 86, 1904.
Haplodothis Höhnel, *Sber. Akad. Wiss. Wien* **120:** 423, 1911.
Cyclodothis H. & P. Sydow, *Annls mycol.* **11:** 266, 1913.
Oligostroma H. & P. Sydow, *Annls mycol.* **12:** 265, 1914.
Scirrhiachora Theiss. & H. Sydow, *Annls mycol.* **13:** 626, 1915.
Septorisphaerella Kleb., *Haupt- und nebenfruchtformen der Ascomyzeten:* 131, 1918.
Ramularisphaerella Kleb., *loc. cit.:* 1918.
Cercosphaerella Kleb., *loc. cit.:* 132, 1918.
Ovosphaerella Laibach, *Centralbl. Bakt. Abt.* 2, **53:** 559, 1921. (validly published in *Centralb. Bakt. Abt.* **2:** 293, 1922).

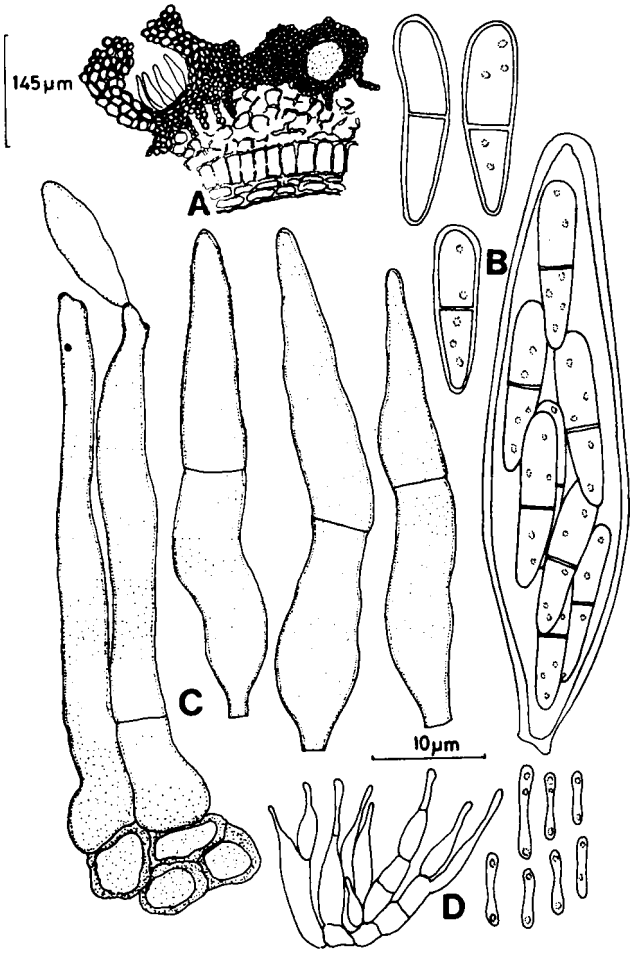


Fig. 93. *Microcyclus ulei.* A, v.s. ascostroma and pycnidium; B, ascus and ascospores; C, conidiophores and conidia; D, spermatiophores and spermatia.

Type sp.: *M. punctiformis* (Pers.: Fr.) Starb., *Bihang Kongl. Svenska Vetensk.-Akad.* **15:** 9, 1889.

Anamorphs: *Cercospora* Fres., *Cercoseptoria* Petrak, *Cercosporella* Sacc., *Cercosporidium* Earle, *Cladosporium* Link, *Colletogloeum* Petrak, *Fusicladiella* Höhnel, *Miuraea* Hara, *Paracercospora* Deighton, *Phaeoisariopsis* Ferraris, *Phloeospora* Wallr., *Pseudocercospora* Speg., *Pseudocercosporella* Deighton, *Ovularia* Sacc., *Ramularia* Unger, *Septoria* Sacc., *Stenella* H. Sydow, *Stigmina* Sacc.

Microconidial state: *Asteromella* Pass. & Thüm. (often erroneously described as *Phoma* Sacc. and *Phyllosticta* Pers. in the literature).

Ascocarps usually black, minute, more or less globose, conic or depressed, ostiolate, immersed to erumpent, scattered singly or aggregated or connected by hyphae. The wall of 1-4 layers is composed of dark brown polygonal cells. Asci often ventricose, oblong, elongate, ovoid or rarely clavate, usually 8 spored, many to few. Ascospores overlapping biseriate or conglomerate in the ascus, septate in or near the middle, constricted or not constricted at the septum, hyaline to occasionally subhyaline or very pale brown with age, smooth to rarely becoming roughened with age, sometimes surrounded by a thin mucilaginous sheath, variable in shape, fusoid, elliptic, oblong, obovate or elongate. Pseudoparaphysoids lacking.

Many species have been described and a large number of them based on hosts. Many more species remain to be described because too little attention has been given to this inconspicuous but interesting species. Cultural investigations will no doubt produce more connections between the teleomorph and anamorph of unknown species.

This genus has been dealt in some detail by von Arx (1949), Barr (1972), and Dennis (1978). Tomilin (1979) has made an extensive revisionary study with keys to 658 species based on host origin but the text is unfortunately in Cyrillic. Barr (1972) treats some North American species and Dennis (1978) some British species. Arx (1949) has discussed the systematic position of *Mycosphaerella* and its relationship to other genera of Mycosphaerellaceae, with a detailed description of twenty species, some with anamorphs.

Mycosphaerella species with Cercospora anamorph

Cercospora Fres.

Mycelium mostly immersed. Stroma often present. Conidiophores fasciculate, straight or flexuous, simple or rarely branched, sometimes geniculate, smooth, pale brown to brown. Conidiogenous cells integrated, terminal, polyblastic, sympodial, cylindrical, cicatrized. Conidial scars thickened with thickenings extending over the whole of the scar except for a small central pore. Conidia solitary, dry, acropleurogenous, simple, obclavate to subulate, colourless, multiseptate, smooth, not catenate (Ellis, 1971).

Key to Mycosphaerella species with Cercospora anamorph

Ascospores not more than 10 μm long, conidia 3-5 septate, 30-60 × 3-4 μm, on *Platanus*..... *M. platanifolia*

Ascospores usually more than 10 μm long but not exceeding 16 μm..... 1

Ascospores usually more than 16 μm long..... 2

1. Conidia 1-6 septate, 35-100 × 3-6 μm, on *Rosa*..... *M. rosicola*

   Conidia 3-8 septate, 40-64 × 3-4 μm, on *Nerium*..... *M. nerii-odori*

   Conidia up to 12 septate, 35-110 × 3-6 μm, on *Arachis*..... *M. arachidis*

2. Ascospores up to 18 μm long..... 3

   Ascospores usually more than 18 μm long..... 4

3. Conidia 1-5 septate, 25-100 × 2-5 μm, on *Alocasia* and *Colocasia*..... *M. alocasiae*

   Conidia 3-6 septate, 13-80 × 4-6.5 μm, on *Cercis*..... *M. cercidicola*

   Conidia up to 12 septate, 60-300 × 2.5-4 μm, on *Gossypium*.. *M. gossypina*

   Conidia up to 18 septate, 40-160 × 3-6 μm, on *Aleurites*..... *M. websteri*

4. Conidia 1-7 septate, 44-100 × 4-5 μm, on *Rhus*..... *M. rhois*

   Conidia up to 13 septate, 20-140 × 1.5-4 μm, on *Melilotus*..... *M. davisii*

M. alocasiae H. & P. Sydow, *Philipp. J. Sci.* **8:** 195, 1913 (Fig. 94).

Sphaerella alocasiae (H. & P. Sydow) Sacc. *et al.* in Sacc., *Syll. Fung.* **24:** 850, 1928.

Anamorph: *Cercospora colocasiae* (Höhnel) Chupp, *A Monograph of the fungus genus Cercospora:* 58, 1954.

Cercospora caladii Cooke var. *colocasiae* Höhnel, *Sber. Akad. Wiss. Wien* **116:** 150, 1907.

Spermogonial state: *Phyllosticta colocasiae* Höhnel, *Sber. Akad. Wiss. Wien* **116:** 142, 1907.

Leaf spots amphigenous, circular, zonate, limited by a light purple or brown margin. Pseudothecia aggregated in the spots, immersed, upto 80 μm broad. Asci 35-45 × 12-15 μm. Ascospores fusoid, not constricted at the septum, 12-18 × 3-5 μm.

Spermogonia immersed, upto 70 μm broad, ostiolate. Spermatia rod-shaped, one celled, guttulate, 3-4 × 1 μm.

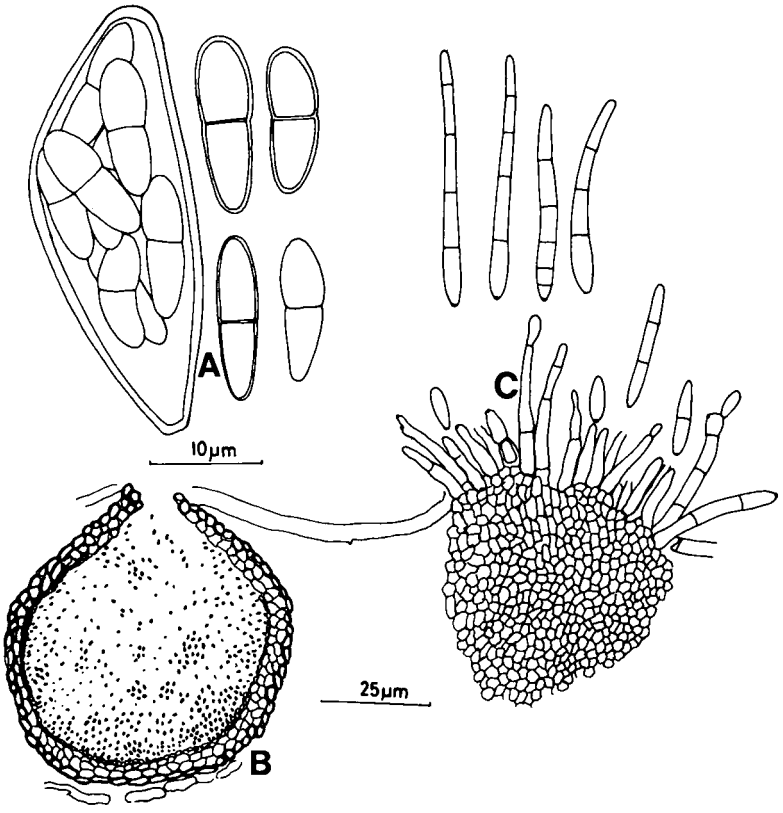


Fig. 94. *Mycosphaerella alocasiae* (type). A, ascus and ascospores; B, v.s. spermogonium; C, conidiophores and conidia.

Conidial stromata amphigenous mixed with pseudothecia. Conidiophores densely fasciculate, simple, not geniculate, 5-30 × 2-4 µm. Conidia obclavate, pale olivaceous, mostly 1-5 septate, sometimes more, 25-100 × 2-5 µm.

On leaves of *Alocasia, Colocasia.* British Solomon Islands, Brunei, India, Indonesia, North Borneo, Philippines, Papua New Guinea, Samoa, Tonga.

M. arachidis Deighton, *Trans. Br. mycol. Soc.* **50:** 328, 1967 (Fig. 95).

Mycosphaerella arachidicola W.A. Jenkins, *J. agric. Res.* **56:** 324, 1938, non *M. arachidicola* Chochrjakov (Khokhryakov), 1934. (= *Didymosphaeria arachidicola*)

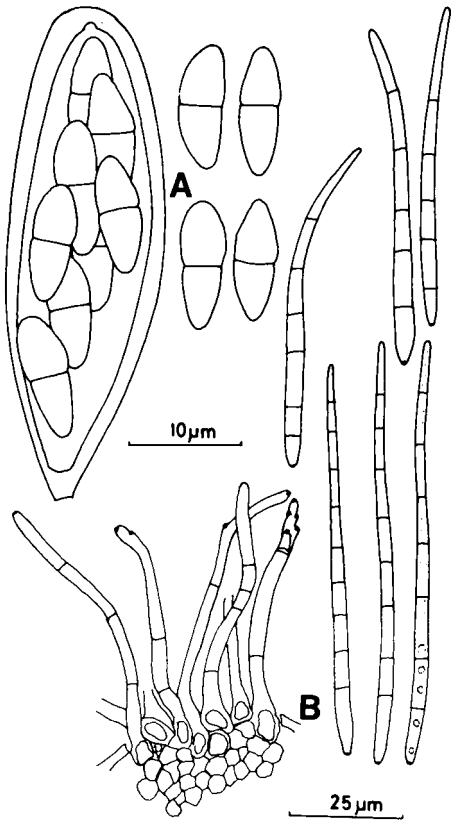


Fig. 95. *Mycosphaerella arachidis.* A, ascus and ascospores; B, conidiophores and conidia.

Anamorph: *Cercospora arachidicola* Hori, *Ann. Rep. Nishigahara agric. Ex. Sta. Tokyo:* **26,** 1917.

Pseudothecia scattered, amphigenous, immersed to erumpent, globose, black, up to 90 μm broad, with papillate ostioles. Asci cylindric-clavate, 25-38 × 7-9 μm. Ascospores 7-16 × 3-4 μm, upper cell somewhat larger than the lower.

Spermogonia similar in appearance to pseudothecia, up to 75 μm broad, ostiolate. Spermatia rod-shaped, hyaline, 1.5-3 × 0.5 μm produced in sterigma-like spermatiophores lining the innermost layer of the spermogonial wall.

Conidial spots circular to irregular, amphigenous, dark brown to black or reddish brown with usually a yellow halo. Stroma dark brown. Conidiophores fasciculate, smooth, mostly geniculate, 15-48 × 3-6 μm. Conidia hyaline to pale olivaceous, obclavate, straight to curved, up to 12 septate, 35-110 × 3-6 μm, with a truncate rounded base and subacute apex.

On *Arachis hypogaea* causing leaf spots. Widespread (*CMI Distribution Map* 166, 1966).

M. cercidicola (Ell. & Kellerm.) Wolf, *Mycologia* **32:** 135, 1940 (Fig. 96A)

Sphaerella cercidicola Ell. & Kellerm., *Bull Torrey bot. Club* **11:** 123, 1884.

Anamorph: *Cercospora cercidicola* Ell., *Am. Nat.* **16:** 810, 1882.

Cercospora cercidicola Ell. var. *coremioides* Tehon, *Mycologia* **16:** 140, 1924.

Pseudothecia densely grouped in the lesions, upto 95 μm broad. Asci 35-45 × 7-8 μm. Ascospores unequally septate, constricted at the septum, 15-18 × 4-5 μm.

Spermogonia upto 80 μm broad. Spermatia rod-shaped, one celled, hyaline, 2-3 × 1 μm.

Conidial spots circular to angular, brown to dark brown necrotic lesions with yellowish green margin, amphigenous. Conidiophores fasciculate, septate, geniculate, brown, 50-300 × 3-5 μm. Conidia obclavate, 3-6 septate, 13-80 × 4-6.5 μm.

On leaves of *Cercis canadensis, C. japonica, C. occidentalis.* U.S.A. The disease is referred to as a leaf spot of red bud. Wolf (1940) has connected both the pseudothecial and conidial states in culture. The conidial state is parasitic. Pseudothecia develop in late summer or early autumn.

M. davisii F. Jones, *Mycologia* **36:** 523, 1944 (Fig. 97).

Anamorph: *Cercospora davisii* Ell. & Ev., *Proc. Acad. Nat. Sci. Philad.* **1891:** 82, 1891.

Pseudothecia scattered, subepidermal on overwintered leaves, upto 100 μm broad. Asci 40-60 × 8-10 μm. Ascospores medianly septate, 12-20 × 4-5 μm, with bluntly pointed ends.

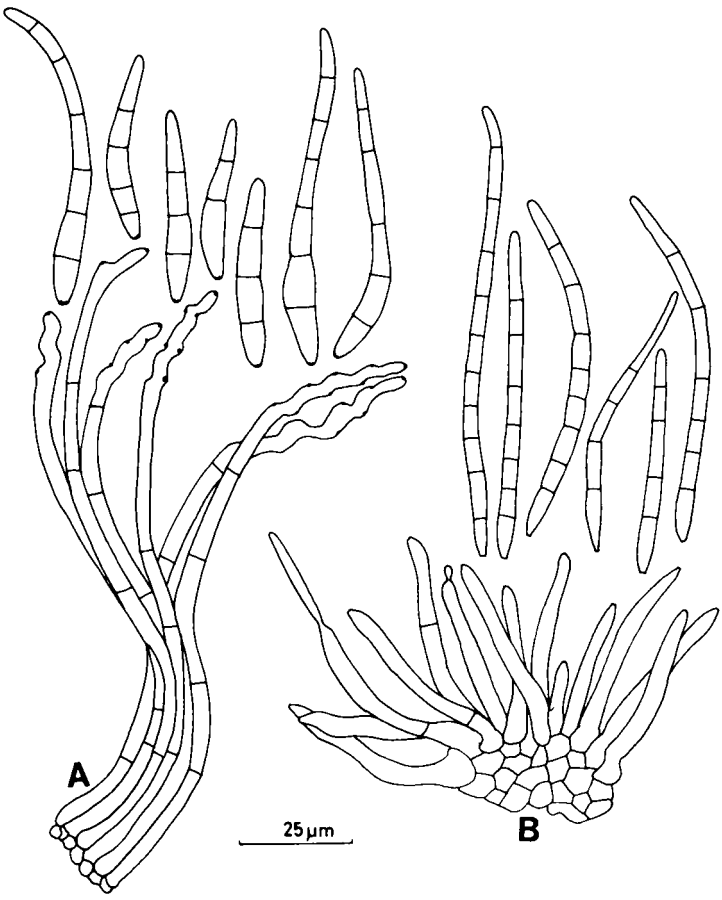


Fig. 96. *Mycosphaerella cercidicola.* A, conidiophores and conidia. *M. aleuritis.* B, conidiophores and conidia.

Spermogonia develop in late summer and autumn on mature and decomposing stems, scattered along the margin of lesions, black, subepidermal, immersed, becoming erumpent, flattened globose to approaching acervulus in shape, ostiolate, upto 120 μm in diam. Spermatia 1.5-3 $\times$ 1 μm, rod-shaped.

Conidial spots amphigenous, irregularly rounded, mostly along the veins, sometimes confluent, greenish yellow to dark brown, with a slightly raised yellow brown border. Conidiophores arising in dense fascicles through the stomata, simple, straight or slightly flexuous, with a bulbous base arising from a stroma of compact hyphae, pale brown,

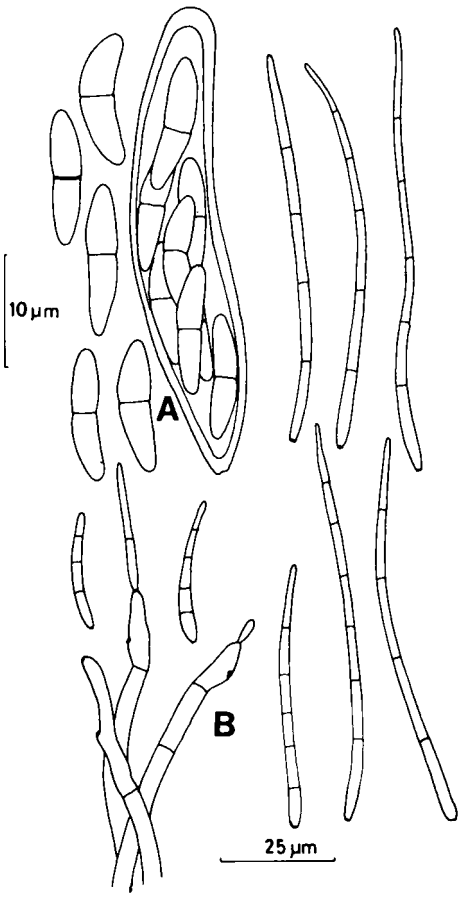


Fig. 97. *Mycosphaerella davisii.* A, ascus and ascospores; B, conidiophores and conidia.

paler towards the apex, 0-3 septate, smooth, 20-85 × 3-6 µm. Conidia cylindrical, straight to curved, hyaline to olivaceous brown, 0-13 septate, 20-140 × 1.5-4 µm.

On leaves and stems of *Melilotus.* Canada, Pakistan, U.S.A.

M. gossypina (Atk.) Earle, *Bull. Ala agric. Exp. Sta.* **107:** 309, 1900 (Fig. 98).

Sphaerella gossypina Atk., *Bull. Torrey bot. Club* **18:** 300, 1891.

Anamorph: *Cercospora gossypina* Cooke, *Grevillea* **12:** 31, 1883.

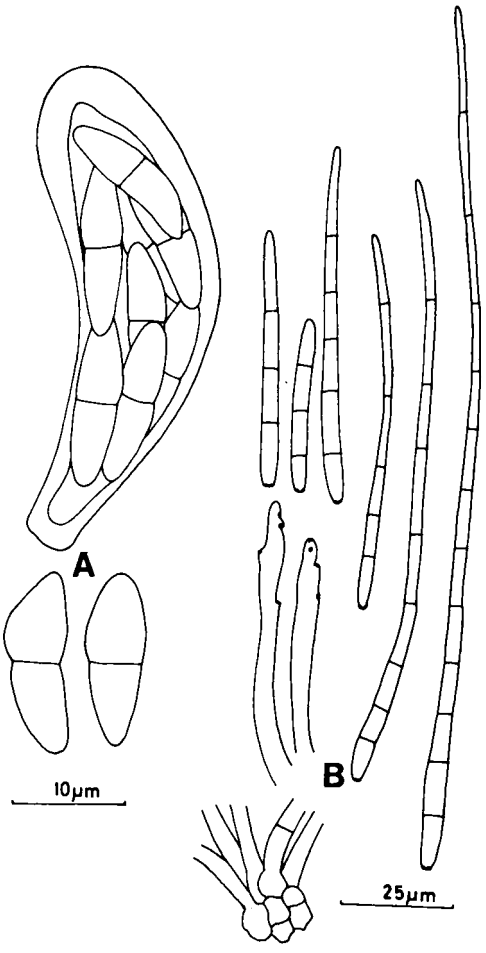


Fig. 98. *Mycosphaerella gossypina*. A, ascus and ascospores; B, conidiophores and conidia.

Leaf spots circular to subcircular with a purple to brown margin, often zonate, more prominent on the upper surface. Pseudothecia immersed, amphigenous, upto 70 μm broad. Asci 40-45 × 8-10 μm. Ascospores elliptical to fusoid, constricted at the septum, 15-18 × 3-4 μm.

Conidial stromata amphigenous, composed of a few large brown cells. Conidiophores fasciculate, simple, geniculate, septate. Conidia hyaline to subhyaline, acicular, upto 12 septate, 60-300 × 2.5-4 μm, base truncate with a prominent scar.

On *Gossypium*. Malawi, Tanzania, U.S.A, Zimbabwe.

M. nerii-odori A. Pande, *Maharashtra V.M. Patrika* **10:** 9, 1975.

Anamorph: *Cercospora nerii-indica* Yamam., *J. Soc. Trop. Agric.* **6:** 605, 1934.

Leaf spots irregular. Pseudothecia stromatic, on dead leaves, upto 85 μm broad. Asci 30-40 × 5-7.5 μm. Ascospores 12-16 × 3-5 μm.

Conidial spots on living leaves, epiphyllous, black, necrotic lesions, oval to irregular. Conidiophores on a stroma, fasciculate, divergent. Conidia olivaceous, cylindrical, 3-8 septate, 40-64 × 3-4 μm, obtruncate at the base and acute at the apex.

On *Nerium odorum*. Formosa, India.

M. platanifolia (Cooke) Wolf, *Mycologia* **30:** 62, 1938.

Sphaerella platanifolia Cooke, *J. Bot.* **21:** 106, 1883.

Anamorph: *Cercospora platanicola* Ell. & Ev., *J. Mycol.* **3:** 17, 1887.

Pseudothecia hypophyllous, immersed, upto 70 μm broad. Asci 30-36 × 7-8 μm. Ascospores 8-10 × 4-4.5 μm.

Spermogonia hypophyllous, upto 65 μm broad. Spermatia rod-shaped, one celled, 2-3 × 1 μm.

Conidial spots amphigenous, irregular. Conidiophores on a stroma, fasciculate. Conidia 3-5 septate, obclavate, 30-60 × 3-4 μm.

On leaves of *Platanus occidentalis*. U.S.A.

M. rhois Chen, *Bot. Bull. Acad. Sci., Taipai* **8:** 140, 1967.

Anamorph: *Cercospora rhoina* nom. nov.

Cercospora rhois Sawada & Katsuki, *Spec. Publ. Coll. Agric. Nat. Taiwan Univ.* **8:** 225, 1959 (non *C. rhois* E. Cast., 1942).

Pseudothecia amphigenous, mostly epiphyllous, upto 160 μm broad. Asci 45-60 × 7-9.5 μm. Ascospores hyaline to light yellow, 17.5-24 × 3-4 μm.

Conidial lesions amphigenous, more distinct on the upper surface. Conidiophores 96-157 × 4-5 μm. Conidia 1-7 septate, hyaline to subhyaline, 44-100 × 4-5 μm, with a truncate base and rounded apex.

On *Rhus semialata* var. *roxburghii, R. javanica* var. *roxburghii*. China.

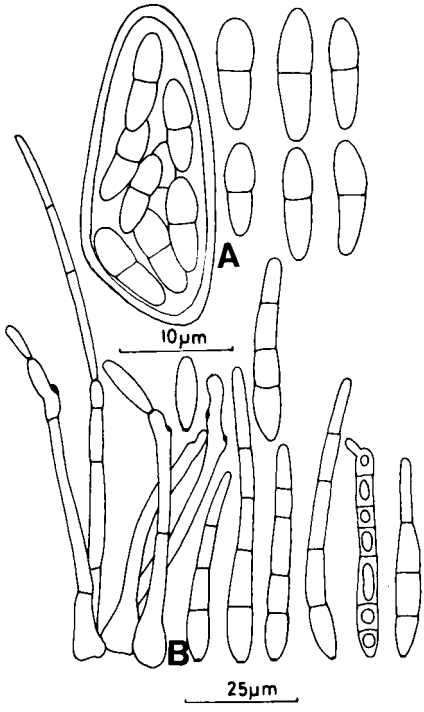


Fig. 99. *Mycosphaerella rosicola*. A, ascus and ascospores; B, conidiophores and conidia.

M. rosicola Davies ex Deighton, *Trans. Br. mycol. Soc.* **50:** 328, 1967 (Fig. 99).

Phaeosphaerella rosicola (Davies ex Deighton) Tomilin, *Key to fungi of the genus Mycosphaerella Johans.:* 285, 1979.

Anamorph: *Cercospora rosicola* Passerini, *Just's bot. Jber.* **3:** 276, 1877 (as '*rosaecola*').

Pseudothecia amphigenous, mostly hypophyllous, immersed becoming erumpent, 120 µm broad. Asci 30-45 × 10-14 µm. Ascospores not constricted, straight or very slightly curved, ends rounded, 12-16 × 3-5 µm.

Conidial leaf spots red brown to purple, circular, amphigenous. Conidiophores arising in dense groups from a subepidermal inconspicuous stroma of few compact dark brown cells, pale brown, paler towards the apex, continuous or 1-2 septate, strongly geniculate, scars prominent, 50-140 × 4-6 µm. Conidia pale to moderately olivaceous, 1-6 (mostly 3-4) septate, smooth, subcylindric, sometimes slightly obcla-

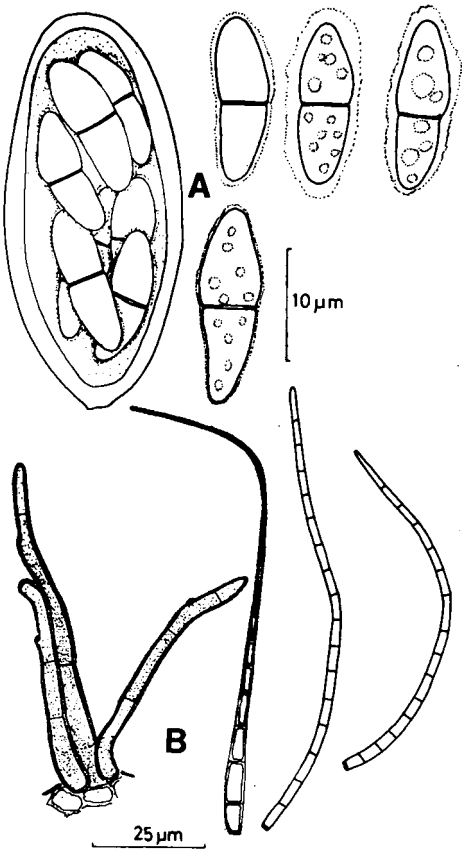


Fig. 100. *Mycosphaerella websteri* (type). A, ascus and ascospores; B, conidiophores and conidia.

vate, broadly rounded at the apex, sometimes hardly or not at all constricted, but often constricted at one or more of the septa, 35-100 × 3-6 µm, with a dark basal hilum.

Occurs on *Rosa* causing leaf spots (Davies, 1938). Europe, Australia, North and South America.

M. websteri Wiehe, *Mycol. Pap.* **55**: 2, 1953 (Fig. 100).

Anamorph: *Cercospora* sp.

Pseudothecia subepidermal, upto 150 µm broad. Asci 30-58 × 9-15 µm. Ascospores, fusiform, slightly constricted at the septum or not constricted, guttulate, 10-18 × 4-6 µm, surrounded by a gelatinous sheath.

Conidiophores amphigenous, pale to dark brown in dense fascicles arising from a thick stroma, geniculate, 20-110 μm long, 3-4 μm thick, with distinct scars. Conidia straight or somewhat curved, subcylindrical, hyaline to pale olivaceous, tapering towards the apex, upto 1-18 septate, with a well-developed thick hilum at the base, 40-160 (mostly 100-140) × 3-6 μm.

On *Aleurites montana*. Malawi.

Mycosphaerella species with Cercosporella anamorph

Cercosporella Sacc.

Primary mycelium internal, stroma present. Conidiophores fasciculate, simple or branched, smooth, emerging through the stromata. Conidiogenous cells integrated, terminal, polyblastic, sympodial, conspicuously cicatrized, geniculate at old conidial scars. Secondary mycelium rare consisting of external repent, hyaline hyphae which bear secondary conidiophores as lateral branches. Conidial scars conspicuous, thickened, colourless and refractive, the thickening extending beyond the areas occupied by the base of the conidium. A minute papilla in the centre of the old scar and a minute frill at the apex of the conidiogenous cell are often seen. Conidia colourless or faintly greenish, smooth, thin-walled, usually subcylindric and slightly obclavate, sometimes fusiform, 1-many septate, with an obtuse apex and narrowed at the base. Hilum slightly convex, colourless, refractive, slightly thickened but often not very conspicuous (Deighton, 1973).

Key to Mycosphaerella species with Cercosporella anamorph

Ascospores not more than 16 μm long..... 1

Ascospores often more than 16 μm long..... 2

1. Ascospores 14-16 μm, conidia 1-3 septate, 20-44 × 6.5-9 μm on *Tinospora*..... *M. tinosporae*

2. Ascospores 16-20 μm long, conidia multiseptate, 40-70 × 3.5-4.5 μm, on *Morus*..... *M. arachnoidea*

   Ascospores 16-24 μm long, conidia 0-1 septate, 38-75 × 3-4 μm, on *Aster, Erigeron, Phyllode* and *Taraxacum*..... *M. taraxaci*

   Ascospores 16-31 μm long, conidia 1-2 septate, 80-115 × 2-2.5 μm, on *Cassiope, Geum, Potentilla* and *Ranunculus*..... *M. ranunculi*

   Ascospores 14-33 μm long, conidia 0-1 septate, 50-140 × 1.3-3.2 μm, on *Saxifraga*..... *M. saxifragae*

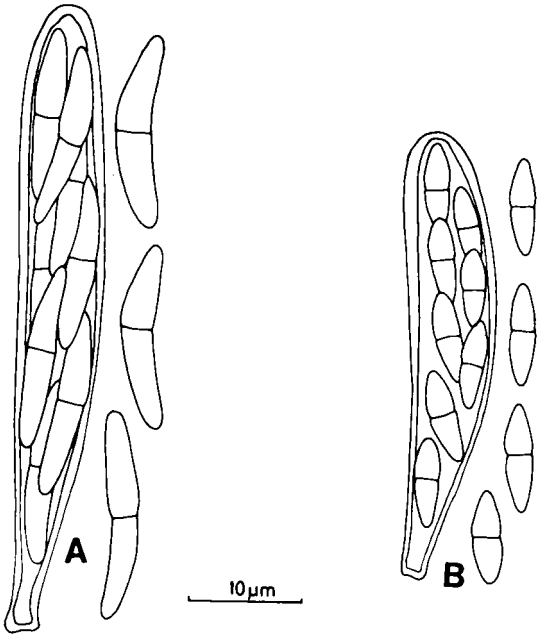


Fig. 101. *Mycosphaerella arachnoidea* (type). A, ascus and ascospores. *M. punctiformis*. B, ascus and ascospores.

M. arachnoidea Wolf, *Mycologia* **28:** 275, 1936 (Fig. 101A).

Anamorph: *Cercosporella arachnoidea* Wolf, *Mycologia* **28:** 275, 1936.

Pseudothecia densely aggregated in dark areas on the dead leaves, mostly hypophyllous, upto 100 μm broad. Asci 45-54 × 7-8.5 μm. Ascospores curved, 16-20 × 3.5-4 μm with the upper cell slightly longer and broader than the lower cell.

Spermogonia mostly epiphyllous, upto 65 μm broad. Spermatia hyaline, rod-shaped, 2-4 × 1-1.25 μm.

Conidial spots yellow to brown on living leaves. Conidia hyaline, indistinctly multiseptate, narrowing at the apex, 40-70 × 3.5-4.5 μm.

On *Morus rubra* causing false mildew of red mulberry. U.S.A.

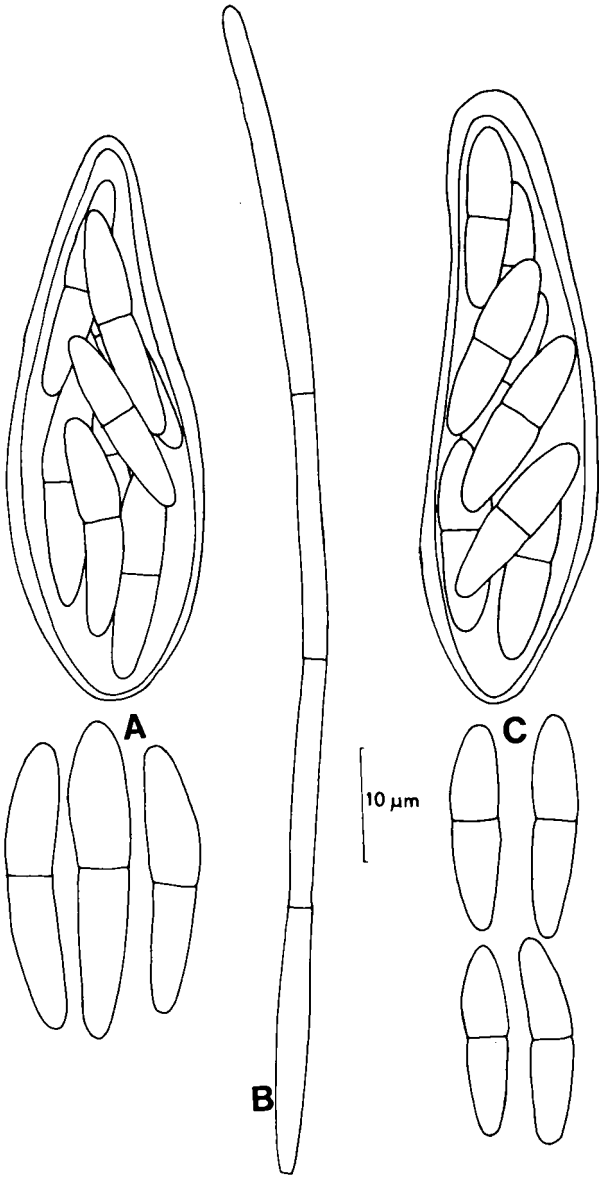


Fig. 102. *Mycosphaerella ranunculi.* A, ascus and ascospores; B, conidium. *M. taraxaci.* C, ascus and ascospores.

M. ranunculi (P. Karsten) Lind, *Meddel. Grønland.* **71:** 167, 1926 (Fig. 102 A,B).

Sphaerella ranunculi P. Karsten, *Öfvers K. Vetens. Akad. Förh.* **2:** 105, 1872.
Sphaerella innumerella P. Karsten, *Mycol. Fenn.* **2:** 182, 1873.
Sphaerella fusispora Fuckel, *Reis. nach Nordpolarmear:* 318, 1874.
Mycosphaerella innumerella (P. Karsten) Starb., *Bih. K. svenska VetenskAkad. Handl.* **15:** 9, 1889.
Sphaerella fusispora Fuckel var. *groenlandica* Allescher, *Bibl. Bot.* **42:** 46, 1897.

Anamorph: *Cercosporella* sp. (Savile & Parmelee, 1964).

Pseudothecia on overwintered leaves and pedicels, scattered or aggregated, upto 150 μm broad. Asci 35-70 × 6.5-21 μm. Ascospores clavate, fusoid, 16-31 × 4-6.5 μm.

Conidial state associated with pseudothecia. Conidiophores fasciculate, divergent, hyaline, simple, 9-12 × 2.5-3.5 μm. Conidia hyaline, 1-2 septate in the lower part, narrowing above, 80-115 × 2-2.5 μm.

On *Cassiope, Geum, Potentilla, Ranunculus.* Canada, Sweden, U.S.A. (Barr, 1972; Savile & Parmelee, 1964).

M. saxifragae (Pass.) Lind, *Det. Kgl. Vidensk. Selskab., Biol. Medd.* **11:** 69, 1934 (Fig. 103).

Sphaerella saxifragae Pass., *Diag. Fungi Nuovi* 1, No. 19, 1887.
Dothidella sphaerelloides Dearn., *Rep. Can. Arct. Exp.* 1913-1918, 4C: 12, 1923.

Anamorph: *Cercosporella saxifragae* Rostrup, *Kristiana Vidensk. Selsk. Forhandl.* **9:** 13, 1891.

Pseudothecia epiphyllous, solitary to aggregated, upto 100 μm broad. Asci 40-50 × 10-15 μm. Ascospores 14-33 × 3-5 μm. Spermogonia with rod-shaped, hyaline, minute spermatia are often associated with immature pseudothecia.

Conidial state free or on the pseudothecia. Conidia 0-1 septate, 50-140 × 1.3-3.2 μm, tapering to a rounded apex.

On *Saxifraga.* Canada, Italy (Savile & Parmelee, 1964).

M. taraxaci (P. Karsten) Lind, *Rep. Sci. Res. Norwegian Exped. Nov. Zeml.,* 1921, **19:** 11, 1924 (Fig. 102 C).

Sphaerella taraxaci P. Karsten, *Hedwigia* **11:** 186, 1872.

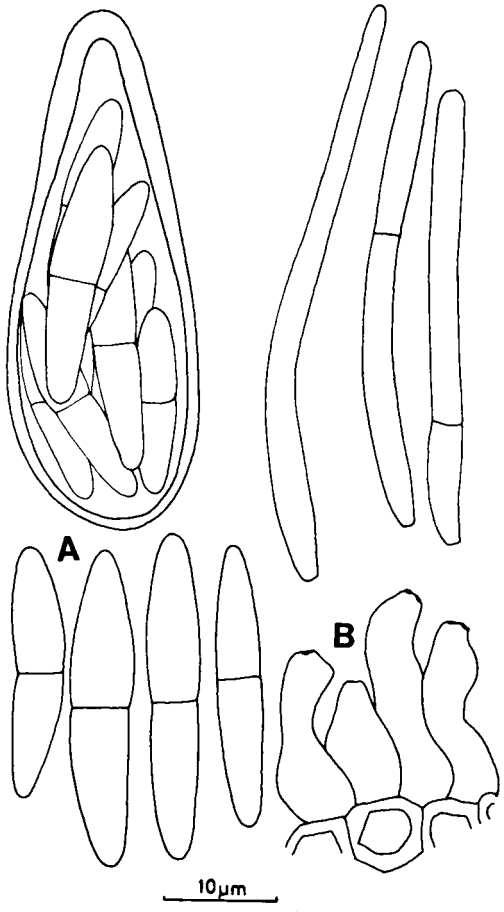


Fig. 103. *Mycosphaerella saxifragae*. A, ascus and ascospores; B, conidiophores and conidia.

Anamorph: *Cercosporella augustana* Ferraris in Ferraris & Massa, *Annls mycol.* **10:** 297, 1912.

Pseudothecia amphigenous, scattered or aggregated, upto 150 µm broad. Asci 30-75 × 11-20 µm. Ascospores clavate fusoid, 16-24 × 3.5-6 µm.

Conidial leaf spots irregularly rounded. Conidiophores mostly hypophyllous, simple, 35-50 × 2.5-3 µm. Conidia hyaline, 0-1 septate, 38-75 × 3-4 µm. Mostly associated with old pseudothecia.

On *Aster, Erigeron, Phyllodoce, Taraxacum*. Canada, Italy, Switzerland, USSR (Barr, 1972; Savile & Parmelee, 1964).

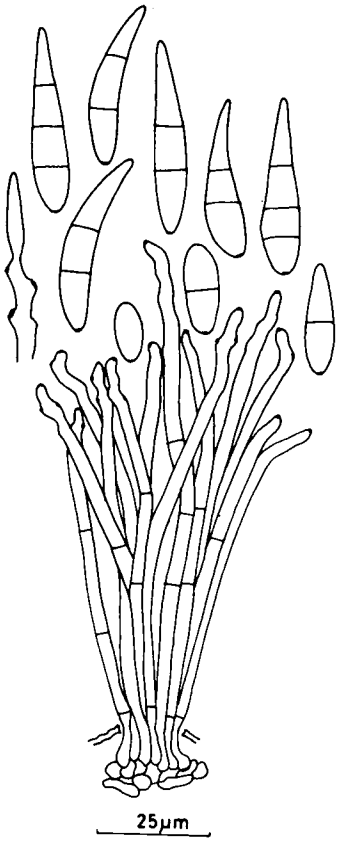


Fig. 104. *Mycosphaerella tinospora*. Conidiophores and conidia.

M. tinosporae Ajrekar ex Mundkur, *Sci. Monog. Counc. Agric. Res. India* **12:** 15, 1938 (Fig. 104).

Anamorph: *Cercosporella tinosporae* (Lacy & Thirum.) Deighton, *Mycol. Pap.* **133:** 35, 1973.

Ramularia tinosporae Lacy & Thirumalachar, *Sydowia* **5:** 126, 1951.

Pseudothecia immersed in spots on leaves, upto 95 µm broad. Ascospores 14-16 × 3-4 µm.

Leaf spots yellow becoming brown, angular and vein-limited, older spots dark brown often with a grey centre. Caespituli hypophyllous, whitish, dense. Conidiophores simple, 0-3 septate, up to 200 µm long, 4-

6.5 μm wide. Conidia hyaline, obpyriform or obclavate, smooth, mostly 1-2 septate, occasionally 3 septate, not constricted, 20-44 × 6.5-9 μm commonly 30-40 × 6.5-8 μm.

On leaves of *Tinospora cordifolia* and *T. malabarica*. Burma, India and Pakistan.

This is the only true *Cercosporella* which has been grown in culture and of which an ascigerous state has been found, but the genetic connection between the ascigerous and hyphomycetous state is not absolutely proved.

Mycosphaerella species with Pseudocercosporella anamorph

Pseudocercosporella Deighton

Mycelium internal. Stromata none or well-developed. Conidiophores emerging through the stomata or erumpent through the cuticle, short, thin-walled, smooth, subcylindric, usually simple, non septate or septate. Conidiogenous cells integrated, sympodial, polyblastic. Conidial scars inconspicuous, not thickened, truncate. Conidia subcylindric or very slightly obclavate cylindric, colourless or almost so, smooth, thin-walled, multiseptate, with a truncate unthickened hilum, not catenate or in a few species catenate.

This genus is very similar in many characters to *Pseudocercospora* and *Cercoseptoria,* but the conidia are colourless and very slightly tapered towards the hilum (slightly obclavate) and are not acicular as in *Cercoseptoria* (Deighton, 1973).

Key to Mycosphaerella species with Pseudocercosporella anamorph

Ascospores 10-15 × 3-5 μm, conidia 2-6 septate, 25-55 × 4-7 μm, on *Carya* and *Juglans*..... *M. caryigena*

Ascospores 18-28 × 3-4.5 μm, conidia 3-7 septate, 50-110 × 2-3.5 μm, on *Lilium*..... *M. martagonis*

M. caryigena Demaree & Cole, *J. Agric. Res.* **44:** 145, 1932 (Fig. 105)

Anamorph: *Pseudocercosporella caryigena* (Ell. & Ev.) comb. nov.

Cylindrosporium caryigenum Ell. & Ev., *Proc. Acad. Nat. Sci. Philad.* **1893:** 166, 1893.
Cercosporella caryigena (Ell. & Ev.) Höhnel, *Ost. Bot. Zeit.* **66:** 106, 1916.
Cercoseptoria caryigena (Ell. & Ev.) J. Davies, *Trans. Wiscons. Acad.* **30:** 6, 1937.

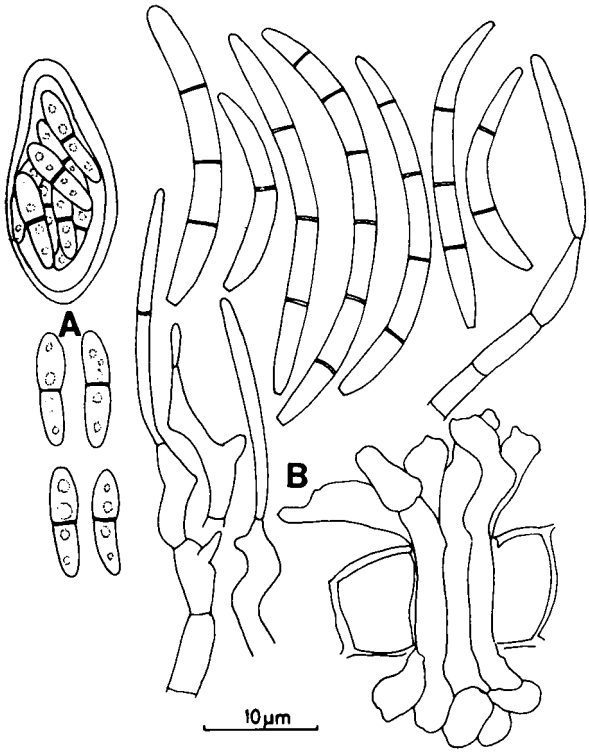


Fig. 105. *Mycosphaerella caryigena.* A, ascus and ascospores; B, conidiophores and conidia.

Pseudothecia hypophyllous, upto 85 µm broad. Asci 45-55 × 7.5-9 µm. Ascospores 10-15 × 3-5 µm, slightly unequally septate.

Spermogonia similar to pseudothecia on lesions caused by the conidial state. Spermatia hyaline, rod-shaped, one celled, 2-3.5 × 1-1.5 µm.

Conidiophores emerging through the stomata, simple, somewhat fasciculate. Conidia hyaline, obclavate cylindric to subcylindric, 2-6 septate, 25-55 × 4-7 µm.

On *Juglans (Hicoria), Carya amara, Carya (Hicoria) cordiformis.* Canada, U.S.A.

M. martagonis von Arx, *Sydowia* **3:** 80, 1949 (Fig. 106).

Anamorph: *Pseudocercosporella hungarica* (Baumler) comb. nov.

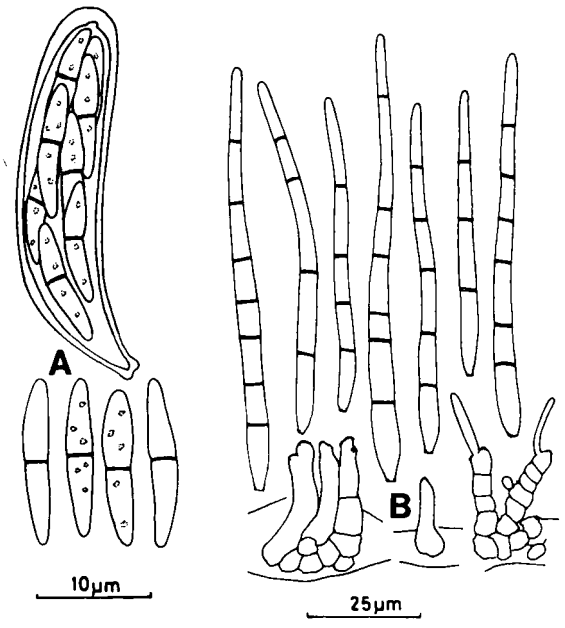


Fig. 106. *Mycosphaerella martagonis* (type). A, ascus and ascospores; B, conidiophores and conidia.

Cercosporella hungarica Baumler, *Verh. Zool.-Bot. Ges. Wien* **38:** 707, 1888.
Cylindrosporium inconspicuum Winter, *Jahrb. d. Nat. Ges. Graub.* **34:** 69, 1890.
Cercosporella hungarica (Winter) Höhnel, *Hedwigia* **42:** (178), 1903.

Pseudothecia mostly epiphyllous, irregularly scattered, upto 100 µm broad. Asci 32-45 × 11-14 µm. Ascospores septate in the middle, 18-28 × 3-4.5 µm.

Conidiophores arise from subcuticular stromata and mycelia, often continuous, short, simple, hyaline 0-3 septate, 10-24 × 5-6 µm. Conidia obclavate, 3-7 septate, hyaline, 50-110 × 2-3.5 µm.

On *Lilium martagon*. Switzerland.

Mycosphaerella species with Pseudocercospora anamorph

Pseudocercospora Speg.

Mycelium internal and external. Stromata present or absent. Conidiophores well developed, fasciculate emerging through the stomata and/or formed terminally and laterally on external mycelium, short or long,

septate or not, simple or branched. Conidiogenous cells integrated, sympodial, polyblastic, denticulate, subgeniculate or more or less sinuous with scars situated at the end of longer or shorter denticles or on distinct or less conspicuous or scarcely visible shoulders, sometimes falsely percurrent with obscure annellations. Conidial scars unthickened. Conidia pale to deep brown, usually obclavate-cylindric, sometimes subcylindric, slightly or distinctly tapered at the base towards the unthickened hilum, straight or curved, smooth to finely verruculose or rugose, multiseptate, usually not catenate (Deighton, 1976).

Key to Mycosphaerella species with Pseudocercospora anamorph

Ascospores upto 12 μm long..... 1

Ascospores usually more than 12 μm long..... 2

1. Conidia 1-9 septate, 45-100 × 3-5 μm, on *Dioscorea*..... *M. contraria*

   Conidia upto 13 septate, 20-200 × 3-4.5 μm, on *Tecoma*..... *M. tecomae*

2. Ascospores upto 15 μm long..... 3

   Ascospores usually more than 15 μm long..... 4

3. Conidia multiseptate, 40-130 × 3-4.5 μm, on *Rubus*..... *M. confusa*

   Conidia 4-12 septate, 40-130 × 3-5 μm, on *Aleurites*..... *M. aleuritis*

4. Ascospores up to 18 μm long..... 5

   Ascospores usually more than 18 μm long..... 6

5. Conidia 1-8 septate, 24-56 × 2-5 μm, on *Populus*..... *M. togashiana*

   Conidia 3-5 septate, 10-100 × 2-6 μm, on *Musa*..... *M. musicola*

6. Ascospores upto 20 μm long..... 7

   Ascospores 10-26 μm long..... 8

7. Conidia 4-9 septate, 35-154 × 3-4.5 μm, on *Legumes*..... *M. cruenta*

   Conidia 1-5 septate, 32-55 × 6-8 μm, on *Ficus*..... *M. bolleana*

8. Conidia 1-16 septate, 25-126 × 3-5.5 μm, on *Pueraria*..... *M. puerariicola*

   Conidia 1-8 septate, 23-120 × 2.5-3 μm, on *Cassia*..... *M. sieberiana*

   Conidia 3-17 septate often with 1-2 vertical or oblique septa, 24-99 × 4-9 μm, on *Vitis*..... *M. personata*

M. aleuritis Ou, *Sinensia* **11:** 183, 1940 (as 'aleuritidis') (Fig. 96B).

Anamorph: *Pseudocercospora aleuritis* (Miyake) Deighton, *Mycol. Pap.* **140:** 138, 1976.

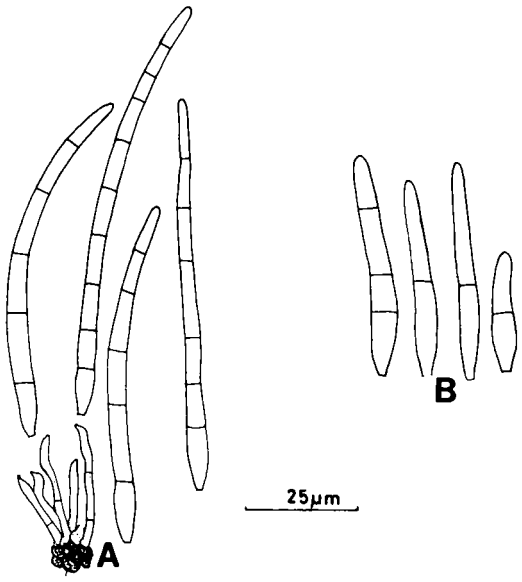


Fig. 107. *Mycosphaerella cruenta* (type). A, conidiophores and conidia. *M. bolleana*. B, conidia.

Cercospora aleuritis Miyake, *Bot. Mag. Tokyo* **26:** 66, 1912 (as '*aleuritidis*')
Cercosporina aleuritis (Miyake) Sacc., *Syll. Fung.* **25:** 902, 1931.

Pseudothecia aggregated in small angular patches, amphigenous, mostly hypophyllous, immersed, up to 100 μm broad. Asci 35-45 × 6-7 μm. Ascospores ellipsoid, the upper cell somewhat larger, 9-15 × 2.5-4 μm.

Spermogonia similar to pseudothecia, subglobose. Spermatia hyaline, aseptate, rod-shaped, 3.5-4.5 × 0.5 μm.

Conidial spots irregular to somewhat rounded, sometimes coalescent, reddish brown to dark brown on the upper surface and olivaceous brown on the underside. Conidiophores amphigenous arising in dense fascicles from a subepidermal stroma, pale olivaceous, 0-5 septate, simple, geniculate, 25-60 × 4-5 μm. Conidia subcylindrical hyaline to pale olivaceous, straight or curved, 4-12 septate, 40-130 × 3-5 μm.

On leaves of *Aleurites*. India, Italy, Japan, Nepal, U.S.A.

M. bolleana Higgins, *Am. J. Bot.* 7: 443, 1920 (Fig. 107B).

Sphaerella bolleana (Higgins) Sacc., *Syll. Fung.* **24:** 879, 1928.

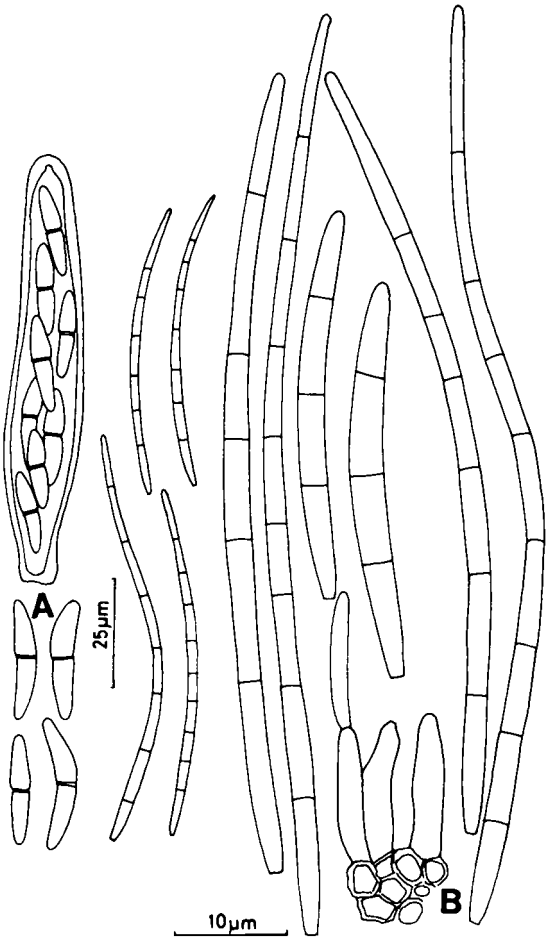


Fig. 108. *Mycosphaerella confusa.* A, ascus and ascospores; B, conidiophores and conidia.

Anamorph: *Pseudocercospora bolleana* (Thüm.) comb. nov.

Septosporium bolleanum Thüm., *Oest. Bot. Zeit.* **27:** 12, 1877.
Cercospora bolleana (Thüm.) Speg., *Michelia* **1:** 475, 1879.
Cercosporidium bolleanum (Thüm.) Liu & Guo, *Acta Mycol. Sinica* **1:** 93, 1982.

Pseudothecia amphigenous, mostly hypophyllous, up to 120 µm broad. Ascospores fusoid to cylindrical, 18-20 × 3.5-5.5 µm.

Spermogonia hypophyllous, up to 90 µm broad. Spermatia rod-shaped, one celled, hyaline, 2-3 × 1 µm.

Conidial spots olive brown, irregular up to 5 μm broad. Conidiophores hypophyllous, 0- sparsely septate, slightly geniculate, single or fasciculate, 50-90 × 5-6 μm. Conidia olivaceous brown, 1-5 septate, smooth lightly echinulate, 32-55 × 6-8 μm.

Pseudothecia and spermogonia on fallen leaves, conidial state parasitic on leaves of *Ficus carica*. Iran, Iraq, Italy, Rumania, U.S.A.

M. confusa Wolf, *Mycologia* **28:** 85, 1936 (Fig. 108).

M. dubia Wolf, *Mycologia* **27:** 355, 1935, non Miles, 1918.

Anamorph: *Pseudocercospora rubi* (Sacc.) comb. nov.

Cercospora rubi Sacc., *Nuovo. G. bot. Ital.* **8:** 188, 1876.
Cercospora septorioides Ell. & Ev., *Publ. Field Mus. Bot.* **1:** 94, 1896.
Cercospora bliti Tharp, *Mycologia* **9:** 108, 1917.

Pseudothecia hypophyllous, up to 60 μm broad. Asci 35-40 × 7-8 μm. Ascospores hyaline to subhyaline, slightly unequally septate, 10-14 × 3-5 μm.

Spermogonia hypophyllous, up to 30 μm broad. Spermatia rod-shaped, one celled, hyaline, 2-3 × 1-1.5 μm.

Conidial spots mostly epiphyllous with dark brown, purplish or grey margin. Conidiophores fasciculate, geniculate, flexuous. Conidia multiseptate, olivaceous brown, 40-130 × 3-4.5 μm.

On *Rubus alleghaniensis, R. argutus, R. hispidus, R. idaeus, R. occidentalis, R. procumbens, R. procumbens* var. *roribaeus, R. strigosus, R. thyrsoides, R. triviatus*. Brazil, U.S.A.

M. contraria Hansford, *Proc. Linn. Soc. Lond.* **153:** 23, 1941 (Fig. 109).

Anamorph: *Pseudocercospora contraria* (H. & P. Sydow) Deighton, *Mycol. Pap.* **140:** 30, 1976.

Cercospora contraria H. & P. Sydow, *De Wildem. Flore Bas- et Moy Congo Fasc.* **1:** 21, 1901.
Cercospora wildemannii H. & P. Sydow, *Annls Mus. r. Congo belge* **3:** 21, 1909.

Pseudothecia immersed, up to 120 μm broad. Asci 28-40 × 8-10 μm. Ascospores, fusiform elliptic, not constricted at the septum, 8-12 × 2-4 μm.

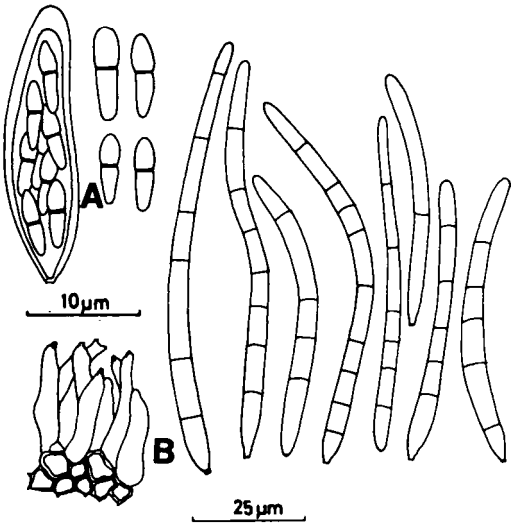


Fig. 109. *Mycosphaerella contraria* (type). A, ascus and ascospores; B, conidiophores and conidia.

Conidiophores arise in dense fascicles through stomata from a small compact stroma composed of few thick-walled dark brown cells, smooth, non septate, pale olivaceous, often geniculate, straight or flexuous, simple, 20-40 × 3-5 µm. Conidial scars conspicuous, thickened. Conidia pale olivaceous, subcylindric, straight or slightly curved, broadly rounded at the apex, shortly tapered at the base to the conspicuous thickened hilum, 1-9 septate, sometimes slightly constricted at one or more of the septa, 45-100 × 3-5 µm.

On *Dioscorea*. Uganda, British Solomon Islands.

M. cruenta Latham, *Mycologia* **26:** 516, 1934 (Fig. 107A).

Anamorph: *Pseudocercospora cruenta* (Sacc.) Deighton, *Mycol. Pap.* **140:** 142, 1976.

Cercospora cruenta Sacc., *Michelia* **2:** 149, 1880.

Pseudothecia on decaying leaves, scattered or somewhat aggregated, mostly hypophyllous, up to 90 µm broad. Asci 35-52 × 7-11 µm. Ascospores 11-19.5 × 3-4 µm with a slightly larger upper cell.

Spermogonia scattered in lesions produced by the conidial state, up to 70 µm broad. Spermatia hyaline, rod-shaped, one celled, 2-2.5 × 1 µm.

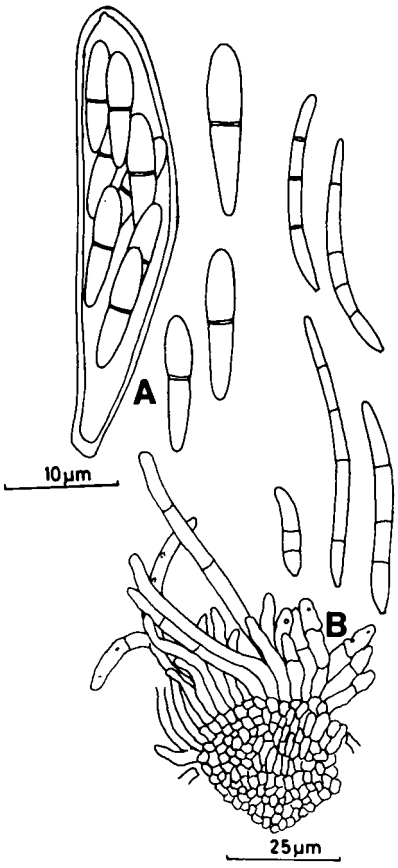


Fig. 110. *Mycosphaerella musicola* (type). A, ascus and ascospores; B, conidiophores and conidia.

Conidial lesions amphigenous, reddish brown, irregular to rounded, variable in size, 2 µm or more. Conidiophores loosely fasciculate, olivaceous brown, simple or rarely branched. Conidia acicular to obclavate, slightly flexuous, 4-9 septate, hyaline to olivaceous, 35-154 × 3-4.5 µm.

On leaves of *Vigna, Dolichos* and *Phaseolus*. British Solomon Islands, Uganda, U.S.A.

M. musicola Mulder in Mulder & Stover, *Trans. Br. mycol. Soc.* **67:** 77, 1976 (Fig. 110).

Anamorph: *Pseudocercospora musae* (Zimmerm.) Deighton, *Mycol. Pap.* **140:** 148, 1976.

Cercospora musae Zimmerm., *Zentrbl. Bakt. Parasit. Infekt. Hyg.* **8:** 219, 1902.

Pseudothecia scattered, up to 75 μm broad. Asci 23-45 × 8-12 μm. Ascospores obtuse ellipsoid, upper cell slightly broader, not constricted, 14-18 × 3-4 μm.

Leaf spots irregularly rounded, elliptic or linear with a grey centre surrounded by a purple to red border or uniformly brown to reddish brown. Stroma brown to black erumpent through the stoma. Conidiophores amphigenous, mostly epiphyllous, in dense clusters, pale olivaceous brown, straight or flexuous, simple rarely branched, continuous without septa or geniculations or scars, ampulliform, 5-25 × 2-6 μm. Conidia olivaceous brown, subcylindrical, straight or curved, 3-5 septate or sometimes more, 10-100 × 2-6 μm with rounded or obtuse apex and unthickened basal hilum.

Causing Sigatoka disease of bananas. Very common and widespread (CMI Descr. Path. Fungi & Bact. No. 414, 1974).

M. personata Higgins, *Am. J. Bot.* **16:** 295, 1929 (Fig. 111).

Anamorph: *Pseudocercospora vitis* (Lév.) Speg., *An. Mus. nac. Hist. nat. B. Aires* **20:** 438, 1910.

Septonema vitis Lév., *Annls Sci. nat. Bot. ser.* 3, **9:** 261, 1848.
Cladosporium viticolum Ces., *Flora* **38:** 206, 1854.
Cladosporium ampelinum Pass., *Erb. Criff. Stal. ser.* 2, No. 595, 1872.
Graphium clavisporum Berk. & Cooke, *Grevillea* **3:** 100, 1874.
Cladosporium vitis (Lév.) Sacc., *Myc.-venet.* No. 284, 1875.
Cercospora vitis (Lév.) Sacc., *Nuovo G. bot. Ital.* **8:** 188, 1876.
Cercospora viticola (Ces.) Sacc., *Syll. Fung.* **4:** 458, 1886.
Isariopsis clavispora (Berk. & Cooke) Sacc., *Syll. Fung.* **4:** 631, 1886.
Helminthosporium vitis (Lév.) Pirotta, *Rev. Mycol.* **11:** 185, 1889.
Phaeoisariopsis vitis (Lév.) Saw., *Rep. Dep. Agric. Govt. Res. Inst. Formosa* **2:** 164, 1922.
Cercospora vitis (Lév.) Sacc. var. *rupestris* Cif., *Annls Mycol.* **20:** 45, 1922.
Cercosporiopsis vitis (Lév.) Miura, *Fl. Manchuria and East Mongolia III Cryptogams, Fungi:* 527, 1928.

Pseudothecia scattered, amphigenous, mostly hypophyllous, up to 90 μm broad. Asci 28-45 × 6-10 μm. Ascospores fusoid, 10.5-22 × 2.5-3.6 μm.

Spermogonia mostly hypophyllous, up to 60 μm broad. Spermatia hyaline, rod-shaped, 2-3 × 1 μm.

Conidial state parasitic on leaves, leaf spots variable. Conidiophores

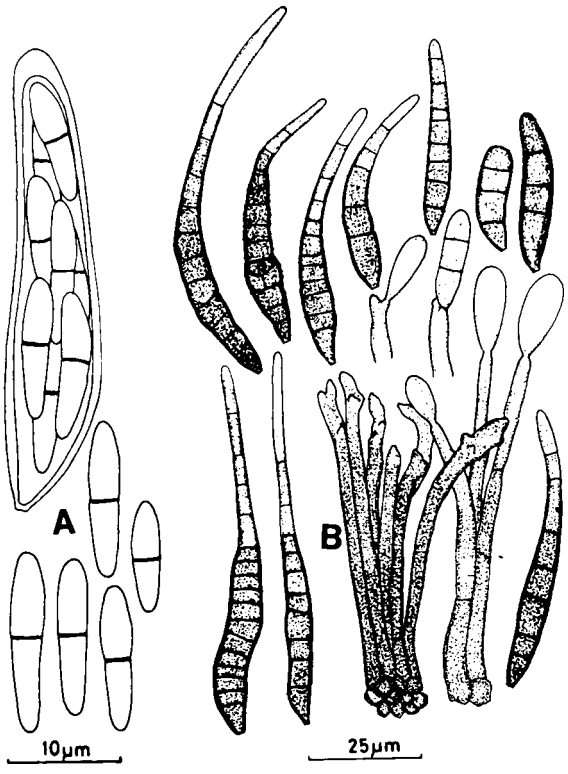


Fig. 111. *Mycosphaerella personata*. A, ascus and ascospores; B, conidiophores and conidia.

fasciculate on a stroma, simple, up to 500 μm long and 7 μm thick, sympodial but sometimes percurrent. Conidia pale to olivaceous brown, mostly obclavate, often rostrate, sometimes fusiform, smooth to verruculose, substraight to slightly curved, 3-17 septate with 1-2 vertical or oblique septa, not or slightly constricted at a few of the septa, 24-99 × 4-9 μm.

On *Vitis vinifera* and other *Vitis* spp. Cosmopolitan.

Deighton (1976) has fully described and illustrated the anamorph.

M. puerariicola Weimer & Luttr., *Phytopathology* **38:** 350, 1948 (Fig. 112).

Anamorph: *Pseudocercospora puerariicola* (Yamam.) Deighton, *Mycol. Pap.* **140:** 151, 1976.

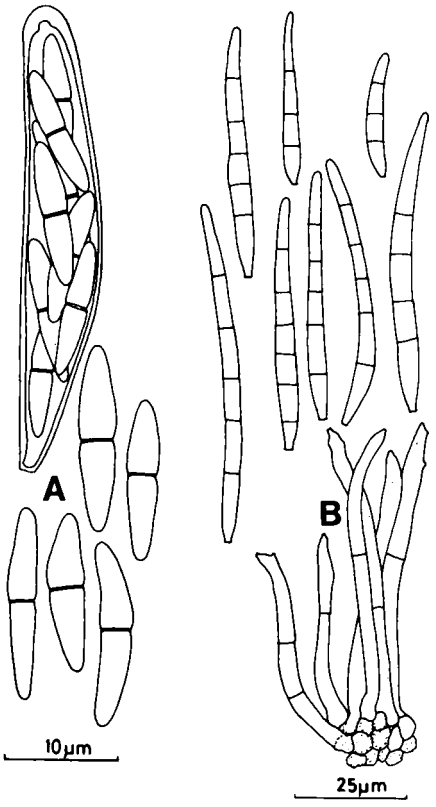


Fig. 112. *Mycosphaerella puerariicola* (type). A, ascus and ascospores; B, conidiophores and conidia.

Cercospora puerariicola Yamam., *Trans. Sapporo nat. Hist. Soc.* **13**: 142, 1934 (as '*puericola*').

Pseudothecia on dead leaves, mostly epiphyllous in leaf spots, up to 95 µm broad. Asci 44-65 × 9-10 µm. Ascospores hyaline to subhyaline, fusoid, 14-23 × 2.5-4.5 µm.

Spermogonia mostly epiphyllous mixed with pseudothecia up to 70 µm broad. Spermatia hyaline, rod-shaped, one celled, 3 × 1 µm.

Conidial spots angular, brown to dark brown with a pale yellow margin. Conidiophores mostly epiphyllous, simple, septate, olivaceous brown, 20-85 × 4-4.5 µm. Conidia hyaline to pale olivaceous, cylindric obclavate, 1-16 septate, straight or curved, attenuated at the apex, rounded at the truncate base, not constricted, 25-126 × 3-5.5 µm.

On *Pueraria thunbergia*. U.S.A.

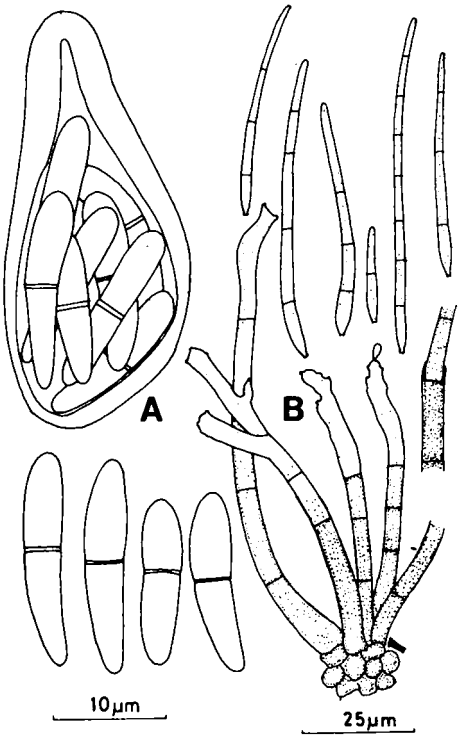


Fig. 113. *Mycosphaerella sieberiana* (type). A, ascus and ascospores; B, conidiophores and conidia.

M. sieberiana Sivan., *Trans. Br. mycol. Soc.* **72:** 157, 1979 (Fig. 113).

Anamorph: *Pseudocercospora* sp.

Leaf spots amphigenous. Pseudothecia epiphyllous, scattered, up to 160 µm broad. Asci broadly saccate to clindrical, 40-65 × 12-18.5 µm. Ascospores fusoid, 19-26 × 3-4.5 µm.

Pseudocercospora state intimately associated with pseudothecia or separate. Conidiophores epiphyllous, simple or rarely branched once, straight to flexuous above, up to 40 µm long, 4-5 µm wide. Conidia pale olivaceous, obclavate, cylindric to obclavate-filiform, usually slightly curved, 1-8 septate, not constricted at the septa, 23-120 × 2.5-3 µm. Stroma composed of brown cells below the conidiophore base.

On leaves of *Cassia sieberiana*. Sierra Leone.

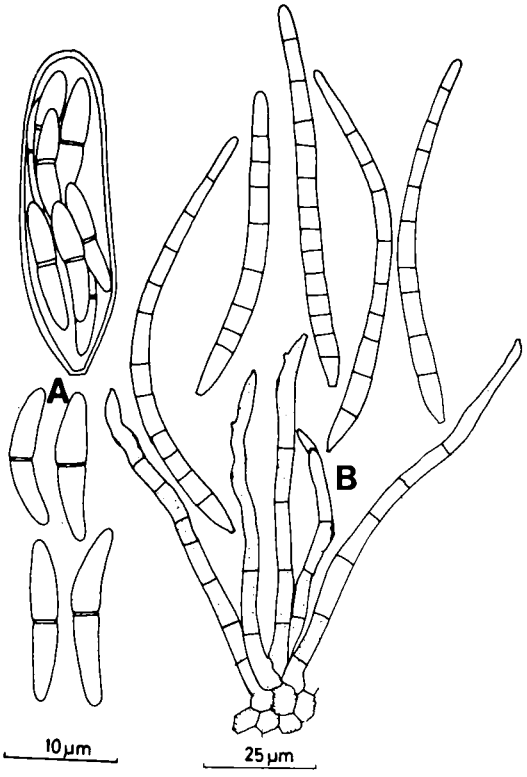


Fig. 114. *Mycosphaerella tecomae* (type). A, ascus and ascospores; B, conidiophores and conidia.

M. tecomae Wolf, *Mycologia* **35:** 507, 1943 non Viegas, 1949 (Fig. 114).

Anamorph: *Pseudocercospora sordida* (Sacc.) Deighton, *Mycol. Pap.* **140:** 153, 1976.

Cercospora sordida Sacc., *Michelia* **2:** 149, 1880.

Pseudothecia scattered, mostly hypophyllous, up to 80 µm broad. Asci 36-45 × 8-10 µm. Ascospores elongate, elliptic, 9-12 × 3-4 µm with an upper broader cell.

Spermogonia amphigenous. Spermatia hyaline, rod-shaped, one celled, 2-3 × 1 µm.

Conidial spots olivaceous brown, mostly hypophyllous. Conidiophores fasciculate on a stroma or solitary as lateral branches, septate, pale olivaceous brown, simple or branched, geniculate, 25-120 × 3-5 µm.

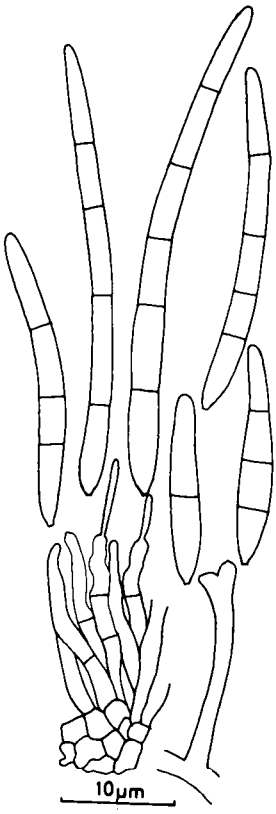


Fig. 115. *Mycosphaerella togashiana*. Conidiophores and conidia.

Conidia pale to mid olivaceous brown, obclavate to cylindric obclavate, up to 13 septate, 20-200 × 3-4.5 µm subobtuse apex and obconic to obconically truncate base.

On *Tecoma radicans*. U.S.A.

M. togashiana Ito & Kobayashi, *Bull. Govt. For. Stn Meguro* **59:** 23, 1953 (Fig. 115).

Anamorph: *Pseudocercospora salicina* (Ell. & Ev.) Deighton, *Mycol. Pap.* **140:** 94, 1976.

Cercospora salicina Ell. & Ev., *J. Mycol.* **3:** 19, 1887.
Cercospora populina Ell. & Ev., *J. Mycol.* **3:** 20, 1887.
Cercospora sessilis Ell. & Ev., *J. Mycol.* **8:** 71, 1902, non Sorokina, 1892.

Cercospora reducta H. & P. Sydow, *Annls Mycol.* **1:** 178, 1903.
Cercospora babylonica Saw., *Rep. Govt. Res. Inst. Formosa* **87:** 79, 1944 (no Latin diagnosis).
Cercospora salicicola Saw., *loc. cit.* **87:** 87, 1944 (no Latin diagnosis).
Cercospora minutipes Yen, *Rev. Mycol.* **31:** 138, 1966.
Cercospora salicis-babylonicae Yen, *Rev. Mycol.* **31:** 138, 1966.

Pseudothecia on overwintered leaves, amphigenous, up to 96 μm broad. Asci 31-43 × 6-8 μm. Ascospores 12-17 × 2.8-4 μm with cells mostly unequal.

Conidial state on living leaves. Conidiophores arising from the stroma, pale olivaceous, fasciculate, simple, straight or curved, up to 30 μm long. Conidia obclavate, slightly curved, hyaline, 1-8 septate, 24-56 × 2-5 μm.

On leaves of *Populus simonii.* Japan. The authors have compared this species with other *Mycosphaerella* species described on *Populus.*

Mycosphaerella species with Paracercospora anamorph

Paracercospora Deighton

Mycelium internal. Stroma present or absent. Conidiophores dilutely coloured, smooth, fasciculate. Conidiogenous cells integrated, terminal, polyblastic, sympodial, cicatrized. Conidial scars moderately conspicuous, with a narrow and slightly thickened rim. Conidia dilutely coloured, subcylindric or obclavate-cylindric, smooth, the hilum with only a narrow and slightly thickened rim, mutate, not catenate.

Paracercospora is distinguished from *Cercospora* by the narrow thickened rim to the conidial scar. In *Cercospora* the thickening extends over the whole of the scar except for the small central pore (Deighton, 1979).

Key to Mycosphaerella species with Paracercospora anamorph

Ascospores 11-16 × 2.5-5 μm, conidia 1-10 septate, 20-132 × 2-5 μm, on *Musa.* ..... *M. fijiensis*

Ascospores 14-20 × 4-6 μm, conidia multiseptate, 51-108 × 3.5-7 μm, on *Musa.* ..... *M. fijiensis* var. *difformis*

M. fijiensis Morelet, *Ann. Soc. Sci. nat. et d'Archéol. Toulon* **21:** 105, 1969 (Fig. 116).

Anamorph: *Paracercospora fijiensis* (Morelet) Deighton, *Mycol. Pap.* **144:** 51, 1979.

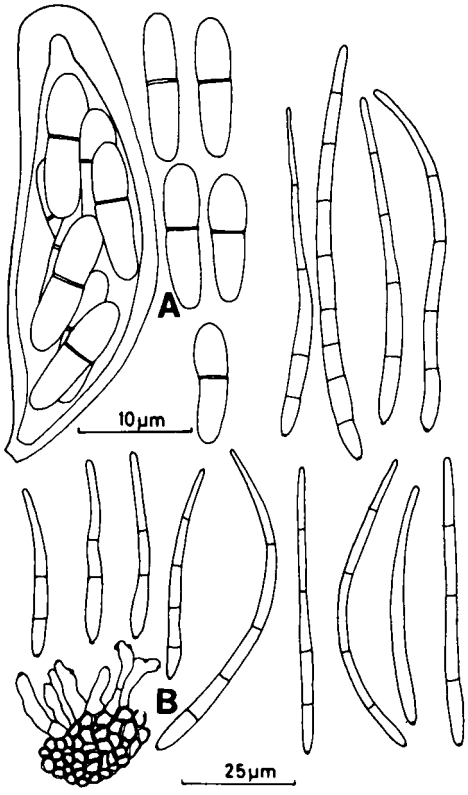


Fig. 116. *Mycosphaerella fijiensis.* A, ascus and ascospores; B, conidiophores and conidia.

Pseudocercospora fijiensis (Morelet) Deighton, *Mycol. Pap.* **140:** 144, 1976.
Cercospora fijiensis Morelet, *Ann. Soc. Sci. nat. et d'Archéol. Toulon Var* **21:** 105, 1969.

Pseudothecia immersed, amphigenous, mostly epiphyllous in spots on leaves, up to 85 µm broad. Asci 40-60 × 10-16 µm. Ascospores slightly constricted at the septum, fusoid-clavate, with the upper cell larger than the lower, 11-16 × 2.5-5 µm.

Spermogonia to 90 µm broad. Spermatia hyaline, rod-shaped, 2.5-5 × 1-2.5 µm.

Conidial leaf spots linear reddish brown streaks, amphigenous, mostly hypophyllous, coalescing becoming black with yellow areas. Stroma absent. Conidiophores single or in small groups, brown, paler towards the apex, simple, or occasionally branched once, 0-5 septate, geniculate,

smooth, cicatrized, 16-60 × 4-7 μm with a swollen base. Conidia subcylindric, straight or curved 1-10 (mostly 4-5) septate tapering towards the apex to an obtuse end, 20-132 × 2-5 μm, with a truncate or rounded base.

Causing black leaf streak disease of banana (Meredith & Lawrence, 1969).

M. fijiensis Morelet var. *difformis* Mulder & Stover, *Trans. Br. mycol. Soc.* **67:** 82, 1976.

Anamorph: *Paracercospora fijiensis* (Morelet) Deighton var. *difformis* (Mulder & Stover) Deighton, *Mycol. Pap.* **144:** 52, 1979.

Cercospora fijiensis Morelet var. *difformis* Mulder & Stover, *Trans. Br. mycol. Soc.* **67:** 82, 1976.

Ascospores 14-20 × 4-6 μm. Spermatia 3.5-4.5 × 1.5-2.5 μm. Conidia multiseptate, 51-108 × 3.5-7 μm.

On *Musa*. Honduras.

Mycosphaerella species with Cercosporidium anamorph

Cercosporidium Earle

Mycelium immersed. Stroma usually well-developed. Conidiophores densely fasciculate, brown, simple, rarely branched, septate or non septate, geniculate or not, fascicles in many species incurved, particularly when old as a result of the formation of a thickened band along one side of the conidiophore. Conidiogenous cells integrated, terminal, polyblastic, sympodial, cicatrized. Conidial scars always thickened and conspicuous, usually prominent, the old scars situated on rounded shoulders or on short peg-like protrusions, but in some species lying more or less flat against the side of the conidiophore. Conidia solitary, dry, acropleurogenous, more or less colourless or relatively pale brown, smooth to verruculose, clavate, cylindrical, obclavate or broadly fusiform, 1-7 septate, with a conspicuous thickened hilum (Deighton, 1967).

Key to Mycosphaerella species with Cercosporidium anamorph

Ascospores 10-20 × 3-4 μm, conidia 1-9 septate, 30-50 × 6.5-7.5 μm, on *Arachis* ..... *M. berkeleyi*

Ascospores 9-14 × 3-4 μm, conidia 1-3 septate, 23-45 × 5-6.5 μm, on

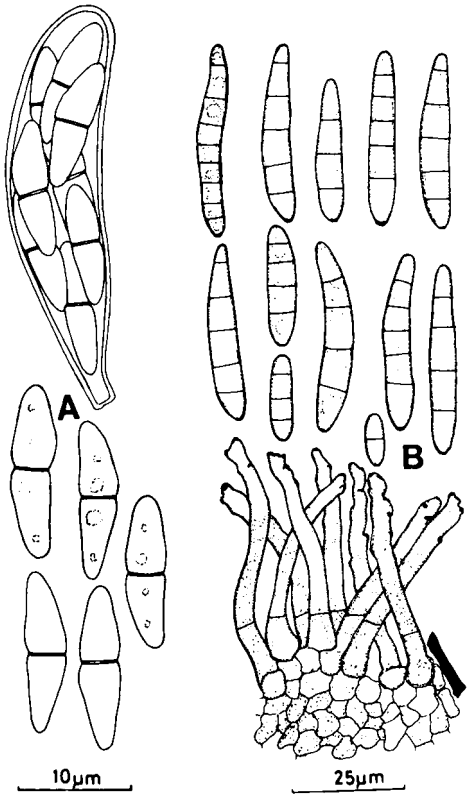


Fig. 117. *Mycosphaerella berkeleyi.* A, ascus and ascospores; B, conidiophores and conidia.

Magnolia..... *M. milleri*

M. berkeleyi W. A. Jenkins, *J. agric. Res.* **56:** 330, 1938 as '*berkeleyii*' (Fig. 117).

Anamorph: *Cercosporidium personatum* (Berk. & M.A. Curtis) Deighton, *Mycol. Pap.* **112:** 71, 1967.

Cercospora personata (Berk. & M.A. Curtis) Ell. & Ev., *J. mycol.* **1:** 63, 1885.
Cercospora arachidis P. Henn. *Hedwigia* **41:** 18, 1902.
Passalora personata (Berk. & M.A. Curtis) S.A. Khan & Kamal, *Pakist. J. Sci. Res.* **13:** 188, 1961.
Septogloeum arachidis Racib. *Z. Pfl Kranh.* **8:** 66, 1898.

Pseudothecia scattered on lesions, amphigenous, up to 150 μm broad. Asci 30-40 × 4-6 μm. Ascospores, upper cell somewhat larger than lower, slightly constricted at the septum, 10-20 × 3-4 μm.

Spermogonia similar in appearance to pseudothecia, amphigenous, ostiolate, up to 90 μm broad. Spermatia rod-shaped, hyaline, 1-3 × 0.5-1 μm, produced in sterigma-like spermatiophores lining the innermost wall layer of the spermogonium.

Conidial leaf spots orbicular, brown to blackish brown, with or without a narrow halo. Stem spots elliptic. Stroma dense and pseudoparenchymatous. Conidiophores often geniculate, simple, 1-3 septate, up to 100 μm long, 4-6.5 μm thick. Conidia pale olivaceous, subcylindric, long fusiform, fusiform obclavate or obclavate, sometimes beaked, rarely clavate, straight or slightly curved, usually finely rough-walled, obtuse or broadly rounded at the apex, shortly tapered at the base to the conspicuous thickened hilum, 1-9 septate, commonly 3-5 septate, sometimes slightly constricted at the septa, 30-50 × 6.5-7.5 μm.

On leaves, stems and stipules of ground nut *(Arachis hypogaea)*. Distributed throughout the tropics and warmer temperate regions wherever the host plant is cultivated.

M. milleri Hodges & Haasis, *Mycologia* **56:** 53, 1964 (Fig. 118).

Anamorph: *Cercosporidium magnoliae* (Ell. & Harkn.) comb. nov.

Cercospora magnoliae Ell. & Harkn., *Bull. Torrey bot. Club* **8:** 27, 1881.
Isariopsis magnoliae Plakidas, *Mycologia* **52:** 258, 1960.
Phaeoisariopsis magnoliae (Ell. & Harkn.) Jong & Morris, *Mycopath. Mycol. Appl.* **34:** 271, 1968.

Pseudothecia aggregated in irregular spots, amphigenous, mostly hypophyllous, up to 120 μm broad. Asci 40-60 × 7-11 μm. Ascospores fusoid, straight or slightly curved, 9-14 × 3-4 μm.

Spermogonia hypophyllous, immersed to erumpent, globose, ostiolate, up to 100 μm broad. Spermatia hyaline, rod-shaped, one celled, 1-2 × 0.5 μm.

Conidial spots orbicular, amphigenous, caespituli hypophyllous. Stroma well-developed, substomatal and subepidermal, 40-80 μm wide and 40-70 μm high, composed of pale olivaceous cells. Conidiophores arising from the stroma rupturing, erect or divergent, more or less straight near the base or sometimes twisted, septate, mostly simple, rarely once branched, smooth to lightly verruculose, geniculate, sharply bent at the old conidial scars, up to 250 μm long, 4-5 μm thick. Conidia hyaline to pale olivaceous, smooth to slightly verruculose, straight or slightly curved, fusiform-obclavate, 1-3 (mostly 2) septate constricted or not constricted at the septa, 23-45 × 5-6.5 μm, the apex varying from broadly rounded to obtuse or acute, base rounded or attenuate to a truncate thickened hilum.

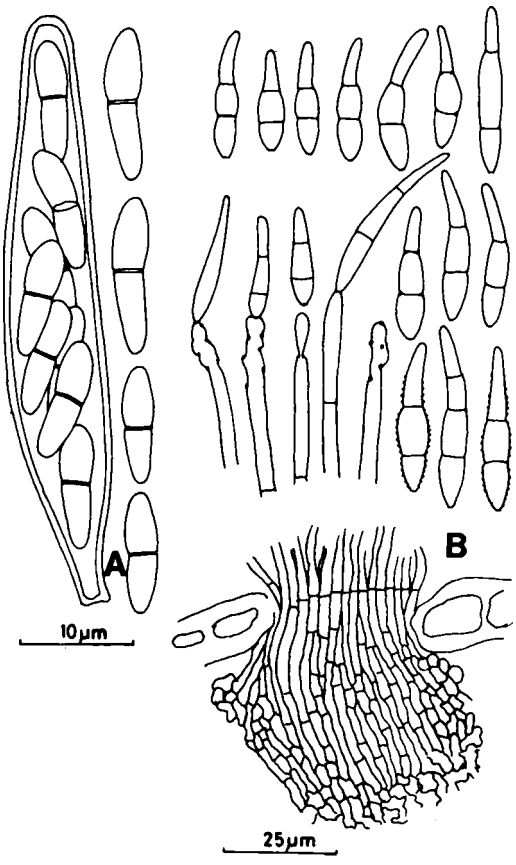


Fig. 118. *Mycosphaerella milleri* (type). A, ascus and ascospores; B, conidiophores and conidia.

Conidial state causes angular leaf spot of *Magnolia* (Hodges & Haasis, 1962, 1964; Plakidas, 1960). U.S.A.

Mycosphaerella species with Cladosporium anamorph

Cladosporium Link: Fr.

Mycelium immersed and also superficial. Stroma sometimes present. Conidiophores mostly simple, rarely branched, straight or flexuous, smooth or verruculose, pale brown to brown. Conidiogenous cells usually integrated, terminal and intercalary, sometimes discrete, polyblastic, sympodial more or less cylindrical, cicatrized. Conidial scars usually prominent. Conidia catenate, sometimes solitary, often in branched chains, acropleurogenous, simple, cylindrical, doliiform,

ellipsoidal, fusiform, ovoid, spherical or subspherical, often with a distinctly protuberant scar at each end or at the base, pale brown to brown, smooth, verruculose or echinulate, 0-3 or rarely more septate (Ellis, 1971).

Key to Mycosphaerella species with Cladosporium anamorph

Ascospores 15-30 × 4.5-9.5 μm, conidia 0-1 septate, 5-23 × 3-8 μm, plurivorous ..... *M. tassiana*

Ascospores 20-30 × 7-9 μm, conidia 1-5 septate, 25-55 × 8-17 μm, on *Dianthus*. ..... *M. dianthi*

Ascospores 25-45 × 7-14 μm, conidia 1-6 septate, 35-70 × 13-25 μm, on *Iris, Gladiolus, Freesia, Hemerocallis* and *Narcissus*..... *M. macrospora*

M. dianthi (Burt.) Jørstad, *Meld. St. plpatol. Inst.* **1:** 17, 1945 (Fig. 119).

Didymellina dianthi Burt., *Trans. Br. mycol. Soc.* **20:** 214, 1936.

Anamorph: *Cladosporium echinulatum* (Berk.) de Vries, *Contribution to the knowledge of the genus Cladosporium Link ex Fr.:* 49, 1952.

Heterosporium echinulatum (Berk.) Cooke, *Grevillea* **5:** 123, 1877.

Pseudothecia up to 270 μm broad. Ascospores, ovate elliptic, slightly constricted at the septum, 20-30 × 7-9 μm with a shorter wide upper cell and long narrow lower cell.

Conidial colonies effuse, sometimes orbicular, olivaceous grey, hairy. Conidiophores smooth, up to 200 μm long and 13 μm thick. Conidia solitary or in short chains, straight to slightly curved oblong or cylindrical, rounded at the ends, pale brown to olivaceous brown, distinctly and densely echinulate, 1-5 (commonly 2-4) septate, 25-55 (mostly 40-50) × 8-17 (mostly 12-15) μm.

Very common on leaves and flowers of *Dianthus* species. Widespread.

M. macrospora (Kleb.) Jørstad, *Meld. St. plpatol. Inst.* **1:** 20, 1945 (Fig. 120).

Didymellina macrospora Kleb., *Ber. dt. bot. Ges.* **42:** (60), 1925.

Anamorph: *Cladosporium iridis* (Fautrey & Roum.) de Vries, *Contribution to the knowledge of the genus Cladosporium Link ex Fr.:* **49**, 1952.

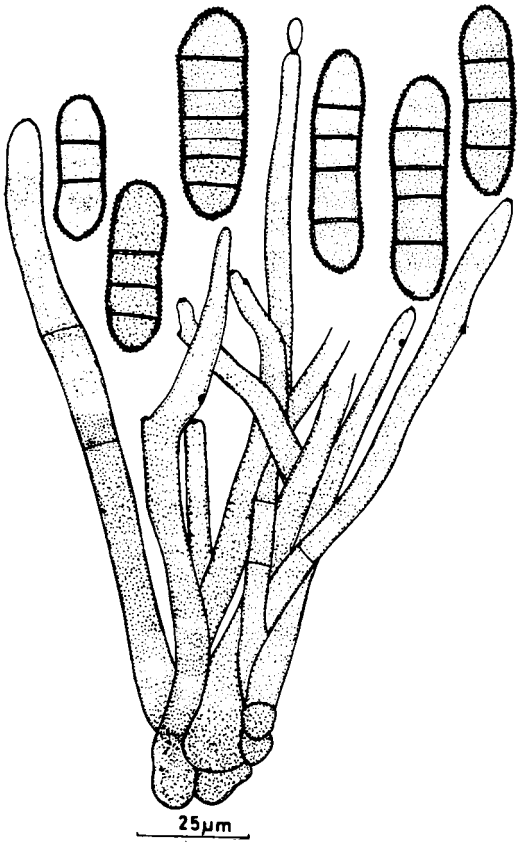


Fig. 119. *Mycosphaerella dianthi.* Conidiophores and conidia.

Scolecotrichum iridis Fautrey & Roum. in Roum. *Rev. Mycol.* **13:** 82, 1891.
Helminthosporium gracile Wallr., *Fl. Crypt. Germ.* **2:** 164, 1833 (as *'Helmisporium'*).
Brachysporium gracile (Wallr.) Sacc., *Syll. Fung.* **4:** 430, 1886.
Heterosporium gracile (Wallr.) Sacc., *Syll. Fung.* **4:** 480, 1886.
Heterosporium iridis (Fautrey & Roum.) Jacques, *Contr. Inst. Bot. Univ. Montréal* **39:** 18, 1941.

The epithet *'gracile'* cannot be used as there is already in existence the name *Cladosporium gracile* Corda, *Icon. Fung.* **1:** 15, 1837.

Pseudothecia immersed in overwintered leaves and stems, globose up to 220 µm broad. Asci 60-110 × 20-40 µm. Ascospores hyaline to subhyaline, ends rounded, constricted at the septum, 25-45 × 7-14 µm.

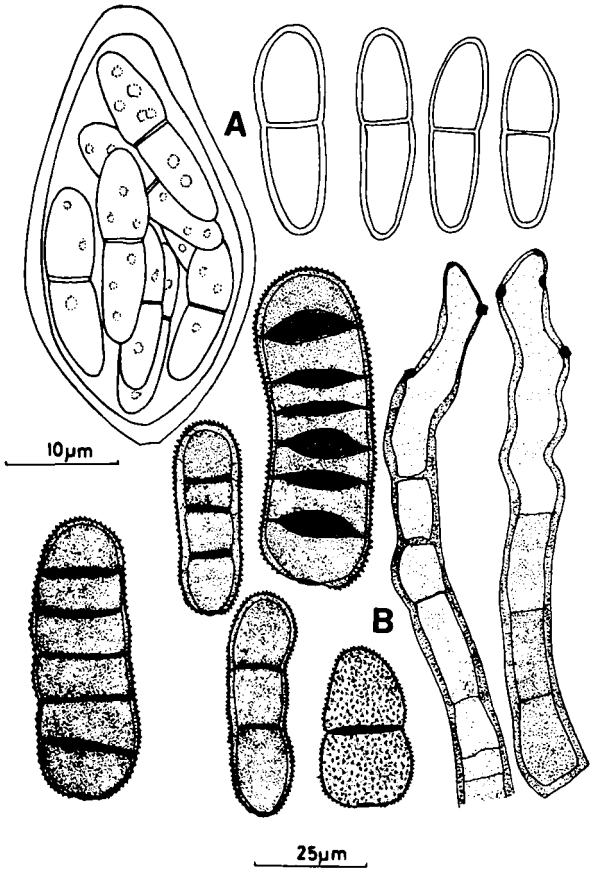


Fig. 120. *Mycosphaerella macrospora*. A, ascus and ascospores; B, conidiophores and conidia.

Conidial colonies effuse or punctiform, dark olivaceous brown, hairy. Conidiophores up to 150 μm long, 8-20 μm thick. Conidia usually solitary, straight or slightly curved, oblong or cylindrical, rounded at the ends, pale to mid brown to olivaceous brown, densely echinulate, 1-6 (commonly 2-3) septate, often slightly constricted at the septa, 35-70 × 13-25 μm.

On *Iris, Gladiolus, Narcissus, Freesia* and *Hemerocallis*. Causing leaf spot and blotch of *Iris*. Distribution: Europe, N. America, South Africa, Australia and Middle East.

M. tassiana (de Not.) Johans., *Öfver. Förh. K. VetenskAkad.* **1884** (9): 167, 1884.

Sphaerella tassiana de Not., *Sfer. Ital.*: 87, 1863.

Anamorph: *Cladosporium herbarum* (Pers.) Link ex Gray, *Nat. Arr. Br. Pl.* **1:** 556, 1821.
(For synonymy see Hughes, *Can. J. Bot.* **36:** 750-751, 1958).

Pseudothecia scattered to aggregated, up to 160 μm broad. Asci 35-90 × 15-30 μm. Ascospores hyaline to rarely pale brown, obovoid, sometimes becoming 2-3 septate when mature, 15-30 × 4.5-9.5 μm.

Colonies effuse, olive green or olivaceous brown, velvety. Stroma often formed. Conidiophores straight to flexuous, often nodose, sometimes geniculate, pale to brown, smooth, up to 250 μm long, 3-6 μm thick. Conidia often in long branched chains, ellipsoidal or oblong, rounded at the ends, pale to mid brown, thick walled, distinctly verruculose with low warts, almost always 0-1 septate, 5-23 × 3-8 μm, with scars at one or both ends.

This species is very common and has been found on many different host plants. Arx (1949) has made a detailed study of a number of species which he included as synonyms of *M. tassiana* and listed many host plants. Barr (1958, 1959) studied the developmental history of this species, and recognised several varieties of it.

Mycosphaerella species with Cercoseptoria anamorph

M. oxyriae Savile in Savile & Parmelee, *Can. J. Bot.* **42:** 715, 1964 (Fig. 121).

Anamorph: *Cercoseptoria oxyriae* (Trail) Gjrum, *Norwegian J. Bot.* **18:** 111, 1971.

Ramularia oxyriae Trail, *Trans. Proc. bot. Soc. Edinb.* **17:** 493, 1889.
Cercosporella oxyriae Rostr., *Meddel. om Grønland* **3:** 629, 1891.

Pseudothecia aggregated on leaves, amphigenous, immersed, up to 180 μm broad. Asci 45-70 × 18-25 μm. Ascospores nonconstricted or slightly constricted at the septum, clavate, 18-30 × 5-7.5 μm.

Conidial spots orbicular with a white, dull green or brown margin. Colonies amphigenous. Conidiophores arising in dense fascicles from an immersed stroma, olivaceous brown to brown, smooth, geniculate, simple, 10-25 × 2-3 μm. Conidiogenous cells integrated, sympodial, polyblastic, falsely percurrent. Conidial scars unthickened, incon-

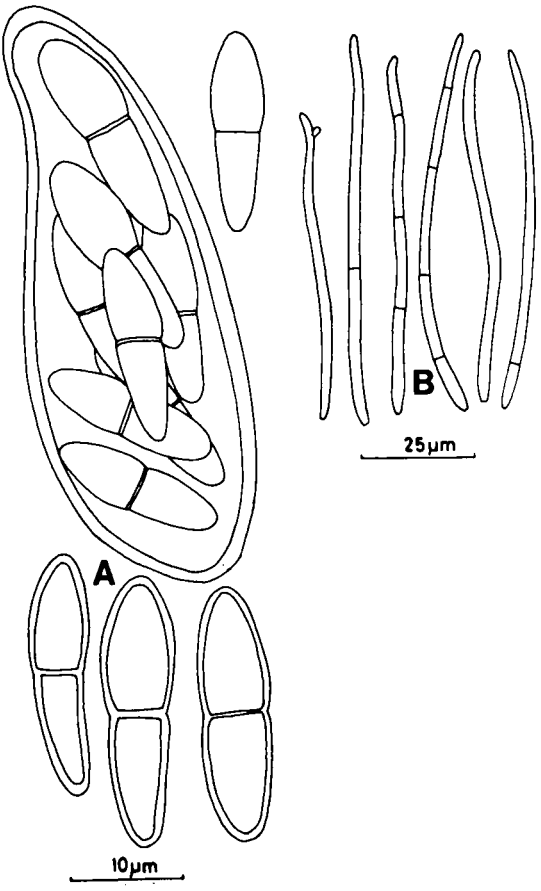


Fig. 121. *Mycosphaerella oxyriae* (type). A, ascus and ascospores; B, conidia.

spicuous. Conidia subcylindrical, smooth, pale brown, straight or flexuous, 0-4 septate, not constricted at the septa, tapering towards the apex, 70-115 × 2-3 µm.

On *Oxyria digyna*. Canada, Greenland, Norway.

Mycosphaerella species with Stenella anamorph

M. citri Whiteside, *Phytopathology* **62:** 263, 1972 (Fig. 122).

Anamorph: *Stenella citri-grisea* (Fisher) comb. nov.

Cercospora citri-grisea Fisher, *Phytopathology* **51:** 300, 1961.

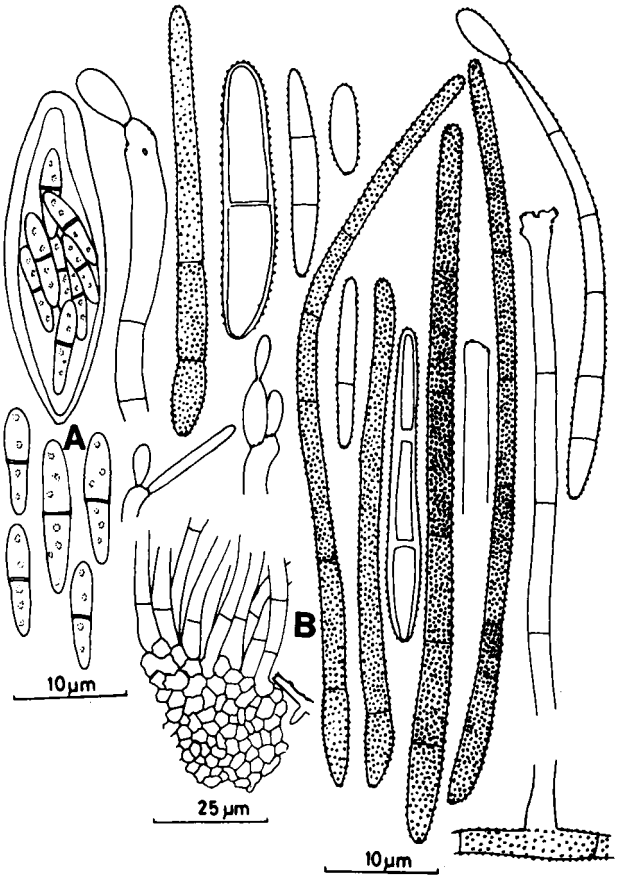


Fig. 122. *Mycosphaerella citri.* A, ascus and ascospores; B, conidiophores and conidia.

Pseudothecia immersed in decomposing leaves, densely grouped, subepidermal, amphigenous, up to 90 µm broad. Asci 25-35 × 8-10 µm. Ascospores fusiform, straight or slightly curved, 6-12 × 2-3 µm.

Spermogonia containing rod-shaped spermatia measuring 2-3.5 × 1 µm are often formed prior to pseudothecial production.

Conidial leaf spots raised, deep olivaceous to dark brown to black, oily, transparent, with diffuse margins surrounded by a yellowish-green border. On fruits, black specks develop between oil glands in the epidermis and underlying mesophyll, often necrotic. Primary mycelium

internal, hyaline, septate, branched. From a small aggregation of somewhat thicker hyphae in the substomatal cavity a few stout olivaceous hyphae arise which penetrate the stoma; these give rise to the secondary mycelium composed of superficial, repent, pale olivaceous, septate, much branched, asperulate hyphae which bear the conidiophores as lateral branches. Some hyphae of the primary mycelium penetrate and ramify within the guard cells of the stomata resulting in black oily lesions. Conidiophores arise mostly from the deeper, brown, smooth, swollen cells of the secondary mycelium as well as directly from the external stromata, erect, straight or slightly flexuous, with few geniculations at an old conidial scar, smooth or asperulate, deep olivaceous, paler towards the apex, septate, simple, wider at the base, 12-80 × 3-6 μm, with prominent thickened, conidial scars, the older ones more or less lying flat against the side of the conidiophore which often elongates after bearing one group of conidia and produces the next conidial group a little distance beyond. Conidia pale olivaceous, asperulate, subcylindric, straight or sometimes slightly curved, catenulate in simple or branched chains, sometimes solitary, the terminal conidia rounded at the apex and tapered to a truncate base, hilum thickened, 0-9 septate, mostly 3-6 septate, 6-50 × 2-4.5 μm.

On *Citrus* causing greasy spot. Also on *Aeglopsis chevalieri* and *Murraya paniculata*. U.S.A. Sivanesan & Holliday (1976) have fully described and illustrated this species.

Mycosphaerella species with Fusicladiella anamorph

M. aronici Volk., *Ber. dt. Bot. Ges.* **21:** 480, 1903.

Sphaerella aronici (Volk.) Sacc. & Trav., *Syll. Fung.* **22:** 134, 1913.
Sphaerella aronici Fuckel, *Symb. mycol.* **3:** 18, 1875 (nom. nud).

Anamorph: *Fusicladiella melaena* (Fuckel) S. Hughes, *Mycol. Pap.* **49:** 21, 1952.

Ramularia melaena Fuckel, *Symb. mycol. Nachtr.* **III:** 35, 1875.
Fusicladium aronici Sacc., *Michelia* **2:** 171, 1880.
Didymaria melaena (Fuckel) Sacc., *Syll. Fung.* **4:** 184, 1886.
Scolecotrichum aronici (Sacc.) Schroeter, *Krypt.-Fl. Schles.* **2:** 497, 1897.
Fusicladiella aronici (Sacc.) Höhnel, *Ber. dt. bot. Ges.* **37:** 155, 1919.
Passalora aronici (Sacc.) Petr. ex Petrak, *Just's Bot. Jahresb.* **56** (1928), Abt. **2:** 533, 1937.

Pseudothecia amphigenous, up to 160 μm broad. Asci 50-80 × 25-40 μm. Ascospores 30-40 × 9-10 μm, not constricted.

Conidial colonies suborbicular or angular, hypophyllous. Mycelium immersed. Stroma sometimes present. Conidiophores hypophyllous, crowded, unbranched, erect, straight or curved, cylindrical, almost colourless, brown, strongly curved later with the curvature always taking place towards the thin-walled side, thick-walled on the other side, smooth to sometimes finely verruculose at the apex, up to 120 μm long, 4-8 μm thick. Conidiogenous cells monoblastic, integrated, terminal, determinate, cylindrical, cicatrized. Conidial scar broad and flat. Conidia dry, solitary, acrogenous, straight or slightly curved, often cylindrical, rounded at the apex, truncate with a thin scar at the base, one septate, colourless to pale olive, smooth to finely verruculose, 28-66 × 8-13 μm.

On leaves of *Aronicum, Cirsium* and *Doronicum*. Europe.

Arx (1950) made a new combination, *Passalora aronici* (Fuckel) von Arx (= *Ramularia aronici* Fuckel, *Fusicladium aronici* Sacc., *Scolecotrichum aronici* Schröeter). This is a later homonym of Petrak's (1937) new combination. Fuckel in 1877 did not publish a species *Ramularia aronici,* whereby stating that his *Sphaerella aronici* showed *Ramularia* conidia. Arx combination is therefore a *nomen nudum* as well as a later homonym (Hughes, 1952).

Mycosphaerella species with Ovularia anamorph

M. pseudomaculiformis (Desm.) Schröet., *Krypt.-Fl. Schles.* **3:** 337, 1894 (Fig. 123).

Sphaeria pseudomaculiformis Desm., *Ann. Sci. Nat. Bot. ser.* 3, **6:** 83, 1846.
Sphaerella pseudomaculiformis (Desm.) Auersw. in Gonnerm. & Rabenh. *Mycol. europ.* **5/6:** 12, 1869.

Anamorph: *Ovularia bulbigera* (Fuckel) Sacc., *Syll. Fung.* **4:** 140, 1886.

Scolecotrichum bulbigerum Fuckel, *Symb. mycol.:* 106, 1870.
Isariopsis bulbigera (Fuckel) Savile, *Can. J. Bot.* **35:** 201, 1957.

Pseudothecia aggregated in dark areas, mostly hypophyllous, up to 100 μm broad. Asci 22-40 × 4.5-7.5 μm. Ascospores elliptic or ovoid, 7.5-14 × 2-3 μm.

Conidiophores arise in groups from subepidermal stromatic hyphae, mostly continuous, rarely septate, 40-70 × 3-4.5 μm. Conidiogenous cells integrated, polyblastic, sympodial, cylindrical, cicatrized. Conidia dry, solitary, one celled, hyaline, globose to spherical, echinulate, with a thick epispore, 8-13 × 7.5-12 μm.

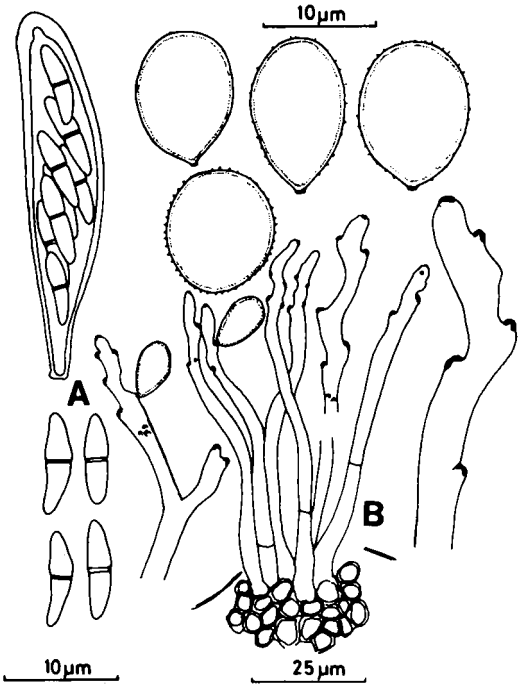


Fig. 123. *Mycosphaerella pseudomaculiformis.* A, ascus and ascospores; B, conidiophores and conidia.

On overwintered leaves of *Sanguisorba* spp. Europe, N. America.

Mycosphaerella species with Phaeoisariopsis anamorph

M. tulipifera (Schwein.) Higgins, *Am. J. Bot.* **23:** 598, 1936 (Fig. 124).

Sphaeria tulipifera Schwein., *Trans. Amer. Phil. Soc.* **4:** 226, 1832.
Sphaerella tulipifera (Schwein.) Cooke, *J. Bot.* **21:** 108, 1883.
Sphaerella fuscans Ell & Ev., *Bull. Torrey bot. Club* **25:** 504, 1898.

Anamorph: *Phaeoisariopsis liriodendri* (Ell. & Harkn.) Morgan-Jones & Brown, *Mycotaxon* **4:** 493, 1976.

Cercospora liriodendri Ell. & Harkn., *Bull. Torrey bot. Club* **8:** 27, 1881.

Pseudothecia scattered on dead leaves, hypophyllous, up to 75 µm

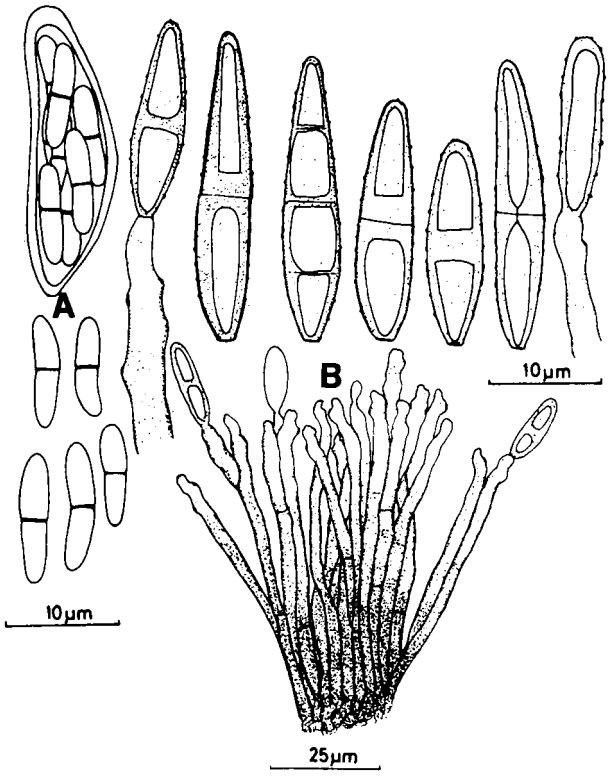


Fig. 124. *Mycosphaerella tulipifera*. A, ascus and ascospores; B, conidiophores and conidia.

broad. Asci 30-45 × 6-7 µm. Ascospores tapering at the ends, 9.5-16.8 × 2.5-3.5 µm.

Spermogonia formed on autumn leaves, mostly hypophyllous, up to 70 µm broad. Spermatia hyaline, one celled, rod-shaped, 2-3 × 0.5-1 µm.

Conidial spots angular often limited by veins, confluent or effuse, brown, Mycelium immersed. Stromata immersed. Conidiophores hypophyllous, fasciculate, brown, geniculate above, septate, 50-150 × 3-5 µm. Conidiogenous cells polyblastic, integrated, terminal, sympodial, cylindrical, cicatrized. Scars thin but distinct, flattened against the side of the conidiogenous cell. Conidia pale brown, pyriform to broadly fusoid. 1-3 (mostly 1-) septate, solitary, dry, acrogenous, 14-34 × 5-7 µm, apex obtuse, base truncate.

Conidial state parasitic, pseudothecia and spermogonia on dead leaves of *Liriodendron tulipifera*. U.S.A.

Mycosphaerella species with Miuraea anamorph

M. pruni-persicae Deighton, *Trans.Br.mycol.Soc.* **50:** 328, 1967.

M. persicae Higgins & Wolf, *Phytopathology* **27:** 695, 1937, non H. & P. Sydow, 1908.

Anamorph: *Miuraea persica* (Sacc.) Hara, *Byogaichau-Hoten:* 224, 1948.

Cercospora persica Sacc., *Nuovo G. bot. Ital.* **8:** 189, 1876.
Cercosporella persica (Sacc.) Sacc., *Michelia* **2:** 20, 1880.
Fusarium persicum (Sacc.) Atkinson, *J. Elisha Mitchell Sci. Soc.* **8:** 41, 1892.
Clasterosporium persicum (Sacc.) Tsugi, *Ann. Phytopath. Soc. Japan* **1:** 33, 1919.

Pseudothecia mostly hypophyllous, more or less aggregated, up to 110 μm broad. Asci 36-55 × 7-10 μm. Ascospores 12-20 × 2.5-3.5 μm, slightly unequally septate with a broader upper cell.

Spermogonia mostly hypophyllous, up to 75 μm broad. Spermatia hyaline, rod-shaped, 2.5-4 × 0.5 μm.

Conidial lesions hypophyllous, yellow to reddish brown. Superficial mycelium emerges through the stoma and forms closely adpressed, much branched hyphal wefts. Conidiophores short, knob-like, arising as lateral branches from the external hyphae. Conidia hyaline to brown, vermicular to clavate, multiseptate, sometimes accumulating in a mass, 17-86 × 2.5-7 μm, formed at the apex of the holoblastic, simple, conidiogenous cell.

On *Prunus persica,* causing Frosty mildew of peach. India, Italy, Japan, Nepal, U.S.A. The genetic connection between the pseudothecial and the conidial state has been demonstrated by cultures and by inoculations on peach leaves.

Mycosphaerella species with Colletogloeum anamorph

M. cryptica (Cooke) Hansf., *Proc. Linn.Soc. N.S.W.* **81:** 35, 1956 (Fig. 125).

Sphaerella cryptica Cooke, *Grevillea* **20:** 5, 1892.
Mycosphaerella nubilosa (Cooke) Hansf. sensu Ganapathi & Corbin, *Trans. Br. Mycol. Soc.* **72:** 237, 1979.

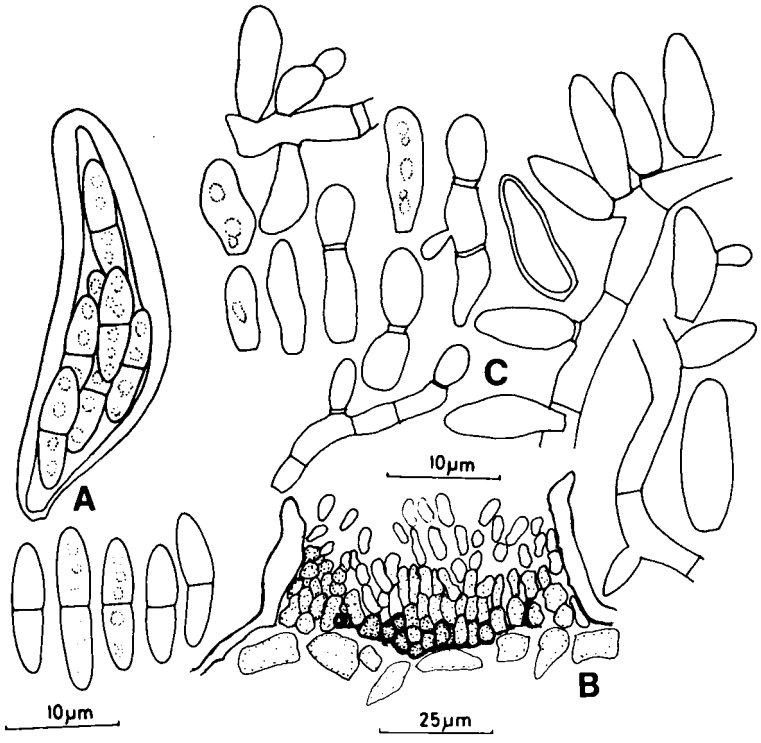


Fig. 125. *Mycosphaerella cryptica*. A, ascus and ascospores; B, v.s. acervulus; C, conidiogenous cells and conidia.

Anamorph: *Colletogloeum nubilosum* Ganapathy & Corbin, *Trans. Br. mycol. Soc.* **72:** 237, 1979.

Spermatial state: *Asteromella* sp.

For descriptions, illustrations and taxonomy refer to Ganapathy & Corbin in *Trans.Br.mycol.Soc.* **72:** 237, 1979 and Park & Keane in *Trans. Br.mycol.Soc.* **79:** 95, 1982.

Pseudothecia amphigenous, immersed, up to 150 μm broad. Asci obovoid, ellipsoid to subsaccate, 30-50 × 9-18 μm. Ascospores conglomerate, ellipsoidal, 1-septate with the upper cell larger, 12-16 × 2.5-5 μm.

Spermogonia on immature lesions, amphigenous, solitary to aggregated, up to 55 μm broad. Spermatia rod-shaped, hyaline, 4-5 × 1-2 μm formed in a mucilaginous matrix.

Conidial lesions amphigenous, sometimes on young twigs and branches, brown to grey. Acervuli subcuticular, rupturing the cuticle by a longitudinal split. Conidiogenous cells arising from the upper cells of the stroma, irregular to doliiform or papillate, monoblastic rarely with 2 conidiogenous loci, with up to 4 annellations. Conidia formed singly at the apex of each conidiogenous cell which after liberation of the first conidium proliferates again, holoblastic, one celled, smooth, cylindrical, subhyaline, straight or curved, with obtuse apex and truncate base under a distinct frill, 8.5-18 × 4-6 μm formed in a mucilaginous matrix.

On *Eucalyptus*. Australia, New Zealand.

Mycosphaerella species with Phloeospora anamorph

Phloeospora Wallr.

Acervulus subepidermal, solitary or confluent, rounded, composed of hyaline to pale brown, thin-walled, angular cells with an irregular dehiscence. Conidiogenous cells holoblastic, obscurely annellidic, discrete, indeterminate, sometimes sympodial, smooth, hyaline, cylindric, formed from the upper cells of the acervulus. Conidia hyaline, septate, smooth, cylindrical, curved, with an attenuating obtuse apex and a truncate base.

Key to Mycosphaerella species with Phloeospora anamorph

Ascospores 12-14 × 3.5-4 μm, conidia 2-4 septate, 29-55 × 4-5 μm, on *Morus*. . ..... *M. mori*

Ascospores 18-24 × 4-5 μm, conidia 4-8 septate, 50-95 × 4-8 μm, on *Crataegus*. ..... *M. oxyacanthae*

Ascospores 20-28 × 3-4 μm, conidia 3-4 septate, 30-60 × 5-6 μm, on *Ulmus*.... ..... *M. ulmi*

M. mori (Fuckel) Wolf, *J. Elisha Mitchell Sci. Soc.* **51:** 165, 1935.

Sphaerella mori Fuckel, *Symb. mycol.:* 106, 1870.

Anamorph: *Phloeospora maculans* (Béreng.) Allesch. in Rabenh., *Krypt.-Fl.* **6:** 935, 1900.

Fusarium maculans Béreng., *Atti Congr. Milano* **1844:** 474, 1844.
Septoria mori Lév., *Ann. Sci. nat.* ser. 3, **5:** 279, 1846.
Phloeospora mori (Lév.) Sacc., *Michelia* **1:** 175, 1878.
Septogloeum mori (Lév.) Briosi & Cav., *I Funghi Parassiti della Piante Coltivate od utili Fasc.* **I,** No. 21, 1888.

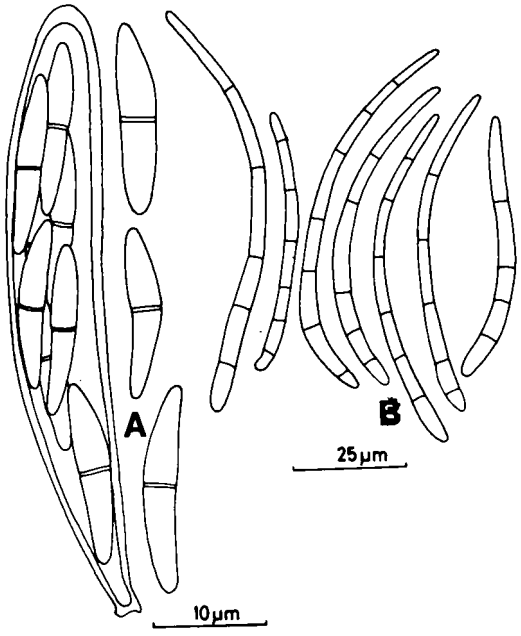


Fig. 126. *Mycosphaerella oxyacanthae*. A, ascus and ascospores; B, conidia.

Cylindrosporium mori (Lév.) Berl., *Riv. Pat. veg. Padova* **5:** 205, 1896.
Phloeospora maculans (Béreng.) Höhnel, *Mitt. bot. Inst. tech. Hochsch Wien* **4:** 77, 1927.
Cercospora pulvinulata Sacc. & Winter f. *angulosa* Săvul. & Sandu, *Herb. Myc. Rom. Fasc.* IV, No. 188, 1930.
Cercosporella maculans (Béreng.) Wolf, *J. Elisha Mitchell Sci. Soc.* **51:** 165, 1935.

Pseudothecia epiphyllous, aggregated, up to 80 µm broad. Asci 35-40 × 5.5-6.5 µm. Ascospores curved, constricted at the septum, 12-14 × 3.5-4 µm with a slightly broader upper cell.

Acervuli up to 200 µm broad. Conidiogenous cells 9-25 × 3-4 µm with an apical annellation. Conidia usually straight, 2-4 septate, cylindrical, obtuse, 29-55 × 4-5 µm with a tapered apex.

Pseudothecia on dead, and conidial state on living leaves of *Morus* spp. Africa, Asia, Australia, Europe, Middle East.

M. oxyacanthae Jaap, *Verh. Bot. Brandenb.* **49:** 15, 1907 (Fig. 126).

Sphaerella oxyacanthae (Jaap) Sacc. & Trotter, *Syll. Fung.* **22:** 127, 1913.

Anamorph: *Phloeospora oxyacanthae* (Kunze & Schmidt) Wallr., *Fl. Crypt. Germ.* **2:** 177, 1833.

Septoria oxyacanthae Kunze & Schmidt, *Mykol. Hefte* **2:** 108, 1823.
Cylindrosporium oxyacanthae (Kunze & Schmidt) Died., *Annls mycol.* **10:** 486, 1912.

Pseudothecia amphigenous, mostly hypophyllous, up to 140 μm broad. Asci 50-60 × 9-12 μm. Ascospores fusoid, upper cell broader than the lower cell, 18-24 × 4-5 μm.

Spots yellow to purple brown, variable. Pycnidia aggregated in spots, mostly hypophyllous, up to 200 μm broad. Conidia subcylindrical, tapering towards the apex, mostly curved, 4-8 septate, pale olivaceous brown, 50-95 × 4-8 μm.

On leaves of *Crataegus oxyacantha*. Europe.

M. ulmi Kleb., *Z. PflKrankh.* **12:** 259, 1902 (Fig. 127).

Sphaerella ulmi (Kleb.) Sacc. & D. Sacc., *Syll. Fung.* **17:** 642, 1905.

Anamorph: *Phloeospora ulmi* (Fr.) Wallr., *Fl.Crypt. Germ.* **2:** 177, 1833.

Septoria ulmi Fr., *Nov. Fl. Suec.* **5:** 78, 1819.
Septogloeum ulmi (Fr.) Briosi & Cav., *I. Funghi Parassiti Piante coltivate od utili Fasc.* **3** & **4,** No. 98, 1890.
Cylindrosporium ulmi (Fr.) Vassil, in Vassil. & Karakulin, *Fung. Imp: Paras. II. Melanconiales:* 580, 1950.

Spermatial state: *Phyllosticta bellunensis* Mart., *Nuovo G. bot. Ital.* **20:** 395, 1888.

Pseudothecia in leaf spots, scattered, up to 100 μm broad. Asci 60-90 × 8-10 μm. Ascospores fusoid, 20-28 × 3-4 μm.

Pycnidia scattered to aggregated in irregular brown spots, hypophyllous. Conidia hyaline to pale olivaceous, subcylindrical or subfusoid, 3-4 septate, straight or curved, tapering towards the apex, 30-60 × 5-6 μm.

On leaves of *Ulmus*. Europe.

Mycosphaerella species with Septoria anamorph

Septoria Sacc.

Pycnidia immersed, solitary or aggregated, globose, brown, thin-

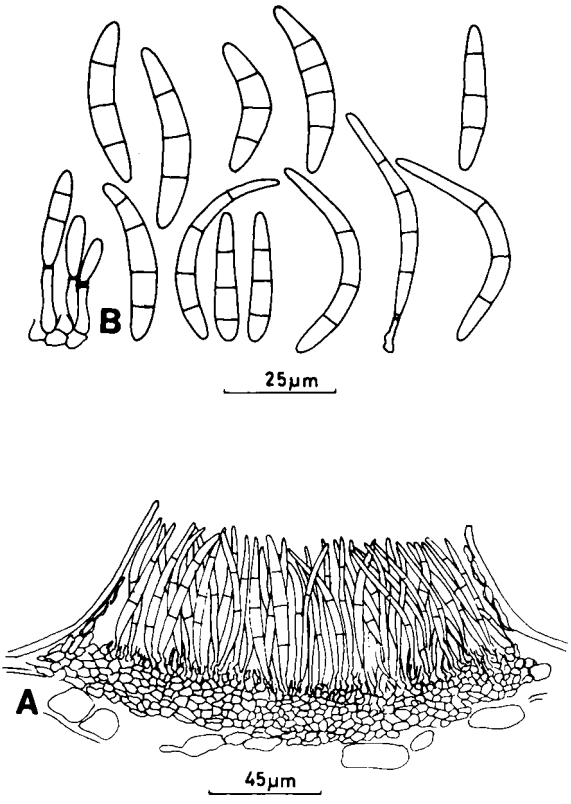


Fig. 127. *Mycosphaerella ulmi.* A, v.s. conidioma; B, conidiophores and conidia.

walled, ostiolate. The wall composed of pale brown angular cells which are somewhat darker and thick-walled around the ostiole. Conidiogenous cells determinate or indeterminate, holoblastic, sympodial, hyaline, smooth, ampulliform, doliiform, lageniform or cylindrical, formed from the cells lining the cavity of the pycnidium. Conidia hyaline, filiform, multiseptate, smooth, not or sometimes constricted at the septa.

Key to Mycosphaerella species with Septoria anamorph

Ascospores 7-9 × 3-4 µm, conidia 1-2 septate, 40-58 × 3-5 µm, on *Pyrus*..... ..... *M. pyri*

Ascospores more than 9 µm long, conidia 0-5 septate..... 1

1. Ascospores less than 17 µm long..... 2

Ascospores usually more than 17 µm long..... 4

2. Conidia 0-3 septate..... 3

   Conidia 1-5 septate, 52-60 × 1-2 μm, ascospores 10.5-15 μm long, on *Coptis*. ..... *M. coptis*

3. Conidia 0-1 septate, 19-28 × 1.5-2 μm, ascospores 11-16 μm long, on *Impatiens*..... *M. impatiens*

   Conidia 1-3 septate, 17-40 × 1.5-3 μm, ascospores 13-17 μm long, on *Linum*. ..... *M. linicola*

   Conidia 2-3 septate, 43-80 × 1.5-2 μm, ascospores 9-16 μm long, on *Triticum* ..... *M. graminicola*

4. Conidia 1-3 septate..... 5

   Conidia 1-5 septate..... 6

5. Conidia one septate, 30-46 × 3-4 μm, ascospores 38-45 μm long, on *Populus*. ..... *M. populi*

   Conidia 2-3 septate, 40-50 × 1-2 μm, ascospores 29-40 μm long, on *Ribes*.... ..... *M. grossulariae*

6. Conidia 1-4 septate, 28-54 × 3.5-4 μm, ascospores 12-28 μm long, on *Populus*..... *M. populorum*

   Conidia 3-4 septate, 40-60 × 2-3 μm, ascospores 20-26 μm long, on *Berberis*. ..... *M. berberidis*

   Conidia 2-5 septate, 45-80 × 3-4.5 μm, ascospores 22-32 μm long, on *Populus*..... *M. populicola*

M. berberidis (Auersw.) Lindau in Engler & Prantl, *Nat. Pflanzenfam.* **1:** 424, 1897 (Fig. 128).

Sphaerella berberidis Auersw. in Gonnerm. & Rabenh., *Mycol. europ.* **5/6:** 3, 1869.

Anamorph: *Septoria berberidis* Niessl, *Hedwigia* **6:** 47, 1857.

Spermatial state: *Asteromella* sp. (von Arx in *Sydowia* **3:** 71, 1949).

Pseudothecia mostly hypophyllous, up to 130 μm broad, grouped in dark brown leaf spots. Asci 45-60 × 8-9 μm. Ascospores 20-26 × 2.5-3.5 μm.

Pycnidia subepidermal, up to 140 μm broad. Conidia cylindrical, 3-4 septate, 40-60 × 2-3 μm, with tapered apex.

Asteromella pycnidia up to 100 μm broad. Spermatia one celled, hyaline, rod-shaped, 2.5-3.5 × 1-1.5 μm.

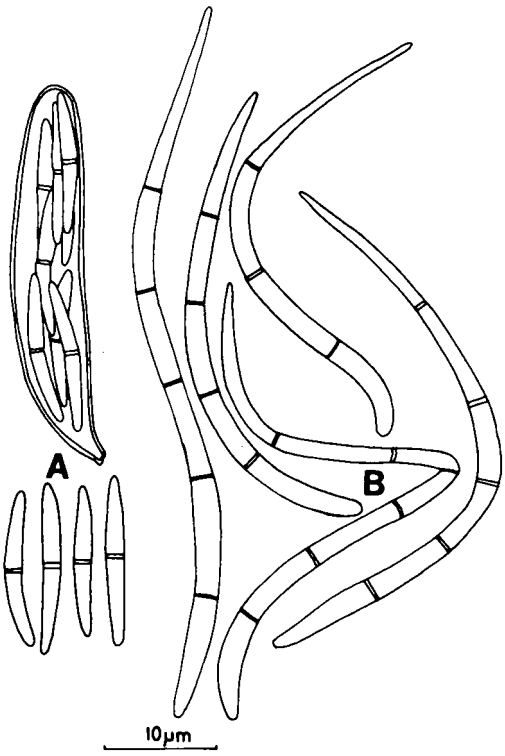


Fig. 128. *Mycosphaerella berberidis.* A, ascus and ascospores; B, conidia.

On leaves of *Berberis vulgaris, Berberis* spp. Europe, Pakistan. From monoascosporic isolates, von Arx (1949) has produced the pycnidial state in culture.

M. coptis (Schwein.) House, *Bull. N. Y. St. Mus.* 233-234: 27, 1921 (Fig. 129).

Sphaeria coptis Schwein., *Trans. Amer. Phil. Soc.* **4:** 224, 1832.
Sphaerella coptis (Schwein.) Farlow, *Appalachia* **3:** 247, 1884.
Laestadia coptis (Schwein.) Ell. & Ev., *North Am. Pyren.:* 261, 1892.

Anamorph: *Septoria coptis* Berk. & M.A. Curtis (as '*coptidis*') in Berk., *Grevillea* **3:** 8, 1874.

Leaf spots grey to greyish white with reddish margin. Pseudothecia mostly hypophyllous, up to 90 µm broad. Asci 25-45 × 7-9 µm. Ascospores fusoid, 10.5-15 × 1.5-3 µm.

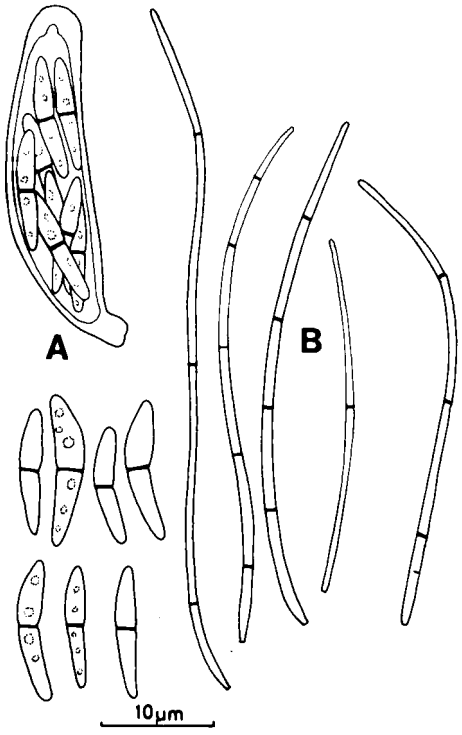


Fig. 129. *Mycosphaerella coptis.* A, ascus and ascospores; B, conidia.

Pycnidia epiphyllous, up to 165 µm broad. Conidia filiform, hyaline, curved, 1-5 septate, 52-60 × 1-2 µm.

On living leaves of *Coptis groenlandica*. U.S.A.

M. graminicola (Fuckel) Schroeter in Cohn, *Krypt.-Fl. Schles.* **3:** 340, 1894 (Fig. 130).

Sphaerella graminicola Fuckel, *Symb. mycol.:* 101, 1870.

Anamorph: *Septoria tritici* Rob. in Desm., *Pl. cryptog. France Ed. 1. Fasc.* **24**, No. 1169, 1842.

Pseudothecia subepidermal, up to 115 µm broad. Asci 30-40 × 11-14 µm. Ascospores elliptical, 9-16 × 2.5-4 µm.

Pycnidia amphigenous, between veins, up to 150 µm broad. Conidia filiform, 2-3 septate, typically curved, gradually tapering to an acute apex,

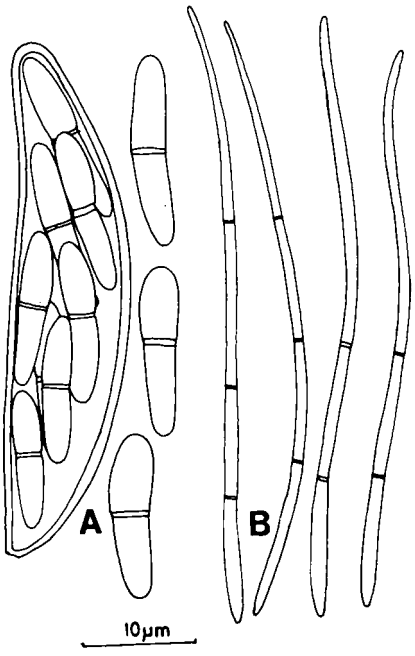


Fig. 130. *Mycosphaerella graminicola* (type). A, ascus and ascospores; B, conidia.

base obtuse, 43-80 × 1.5-2 µm, formed on a narrow obpyriform, hyaline phialide.

On *Triticum*. Australia, Cyprus, Ethiopia, Europe, Iraq, Israel, Kenya, Tanzania.

M. grossulariae (Auersw.) Lindau in Engler & Prantl, *Nat. Pflanzenfam.* **1:** 424, 1897.

Sphaerella grossulariae Auersw. in Gonnerm. & Rabenh., *Mycol. europ.* **5/6:** 11, 1869.

Anamorph: *Septoria ribis* Desm., *Mem. Soc. Sci.:* 101, 1842.

Spermatial state: *Phyllosticta grossulariae* Sacc., *Syll. Fung.* **3:** 17, 1884.

Pseudothecia amphigenous, mostly hypophyllous, scattered to somewhat aggregated on overwintered leaves. Asci 45-75 × 9-16 µm. Ascospores fusoid, elongate, 29-40 × 3-5 µm.

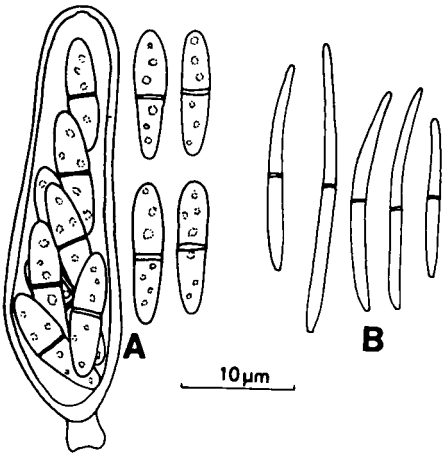


Fig. 131. *Mycosphaerella impatiens*. A, ascus and ascospores; B, conidia.

Conidial state forming leaf spots on living leaves. Pycnidia mostly hypophyllous. Conidia hyaline, filiform, 2-3 septate, 40-50 × 1-2 µm.

On *Ribes*. Europe, N. America. The connection between the pycnidial state and the teleomorph has been demonstrated by Stone (1916) and Klebahn (1918).

M. impatiens (Peck & Clinton) House, *Bull. N.Y. St. Mus.* **233-234:** 28, 1921 (Fig. 131).

Sphaerella impatiens Peck & Clinton, *Ann. Rep. N.Y. St. Mus.* **30:** 67, 1878.

Anamorph: *Septoria* sp.

Leaf spots reddish brown to dull brown, angular. Pseudothecia amphigenous, mostly hypophyllous, up to 180 µm broad. Asci 20-50 × 8-12.5 µm. Ascospores 11-16 × 2.5-5 µm, elliptic or obovoid, inequilateral to slightly curved.

Pycnidia similar in appearance to pseudothecia, amphigenous, up to 210 µm broad. Conidia hyaline, filiform, 0-1 septate, curved, 19-28 × 1.5-2 µm.

Both states are often found intermingled on the same leaf spot.

On *Impatiens capensis, I. pallida*. U.S.A.

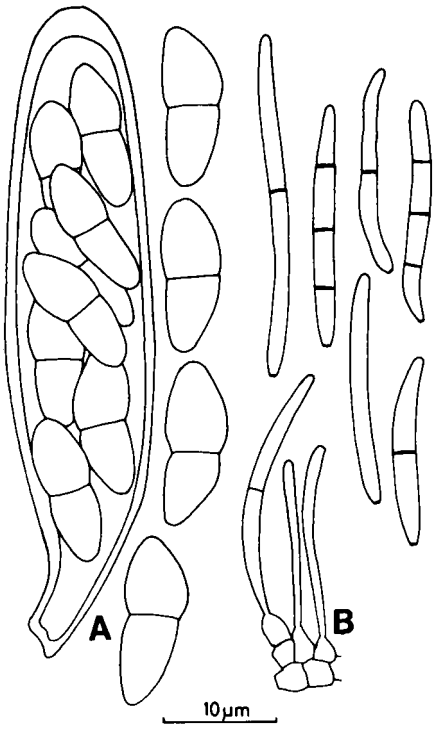


Fig. 132. *Mycosphaerella linicola.* A, ascus and ascospores; B, conidiogenous cells and conidia.

M. linicola Naum., *Mat. Mycol. Phytopath.* **5:** 2, 1926 (Fig. 132).

Sphaerella linorum Wollenw., *Rev. Bot. Inst. Miguel Lillo* **2:** 490, 1938.
Mycosphaerella linorum (Wollenw.) Garcia-Rada, *Min. Fomento Dir. Agric. Ganard Peru Informe* **54:** 13, 1942.

Anamorph: *Septoria linicola* (Speg.) Garassini, *Rev.Fac.Agron.Univ. nac.La Plata* **22:** 104, 1938.

Phlyctaena linicola Speg., *An. Mus. nac. Hist. nat. B. Aires* **20:** 389, 1910.
Septoria linicola (Speg.) Garcia-Rada, *Min. Fomento Dir. Agric. Ganard Peru Informe* **54:** 13, 1942.

Pseudothecia mostly hypophyllous, up to 150 µm broad. Asci 34-50 × 8-9 µm. Ascospores 13-17 × 2.5-4 µm.

Pycnidia up to 120 µm broad. Conidia filiform, hyaline, 1-3 septate, 17-40 × 1.5-3 µm.

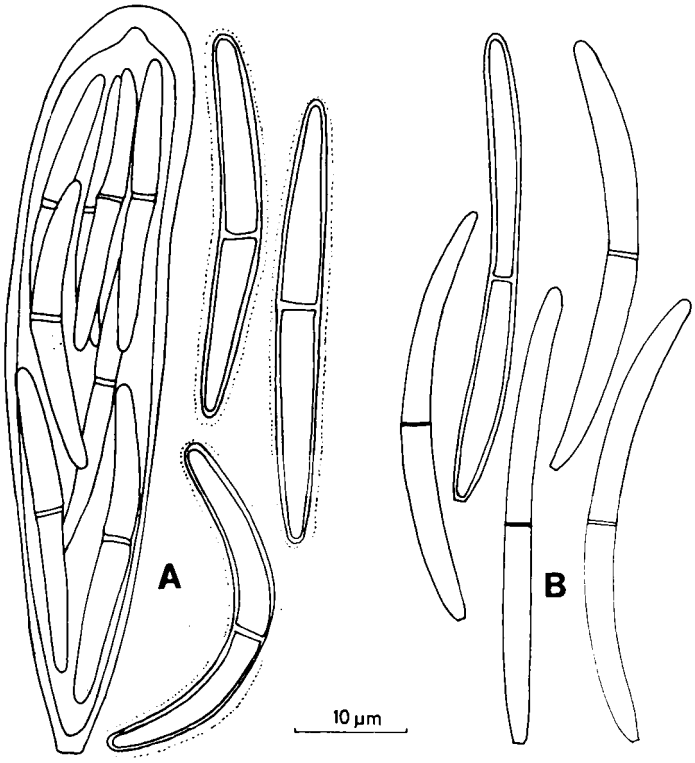


Fig. 133. *Mycosphaerella populi.* A, ascus and ascospores; B, conidia.

On leaves, stems, peduncles of *Linum usitatissimum, L. marginale.* Europe, Australia, Africa. (Sivanesan, A. & Holliday, P., CMI Descr. 709, 1981).

M. populi (Auersw.) Schroeter in Cohn, *Krypt.-Fl. Schles.* **3:** 336, 1894 (Fig. 133)

Sphaerella populi Auersw. in Gonnerm. & Rabenh., *Mycol. europ.* **5/6:** 11, 1869.
Mycosphaerella balsamopopuli Nev., *Fungi of the U.S.S.R. Fasc.* **1**, No. 7, 1952.

Anamorph: *Septoria populi* Desm., *Ann. Sci. Nat.* ser. 2, **14:** 345, 1843.

Leaf spots orbicular, scattered to confluent with a white centre and grey margin. Pseudothecia in irregularly rounded spots, up to 150 µm broad. Asci 70-95 × 12-18 µm. Ascospores cylindric-elongate, hyaline to pale olivaceous, 38-45 × 4-5 µm, with gelatinous sheath.

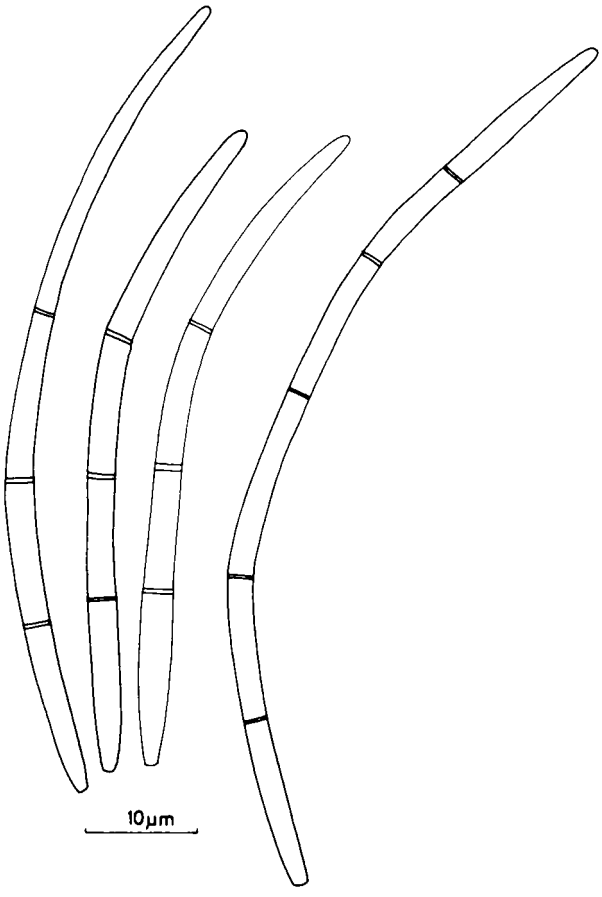


Fig. 134. *Mycosphaerella populicola*. Conidia.

Pycnidia amphigenous, mostly epiphyllous. Conidia filiform, straight to somewhat curved, septate in the middle, hyaline to pale olivaceous, 30-46 × 3-4 µm, with rounded ends.

On *Populus*. Europe.

M. populicola Thompson, *Phytopathology* **31:** 251, 1941 (Fig. 134).

Anamorph: *Septoria populicola* Peck, *Ann. Rep. N.Y. St. Mus.* **40:** 61, 1886.

Pseudothecia mostly hypophyllous on fallen leaves in the spring, scattered to slightly aggregated, up to 160 µm broad. Asci 64-90 × 13-

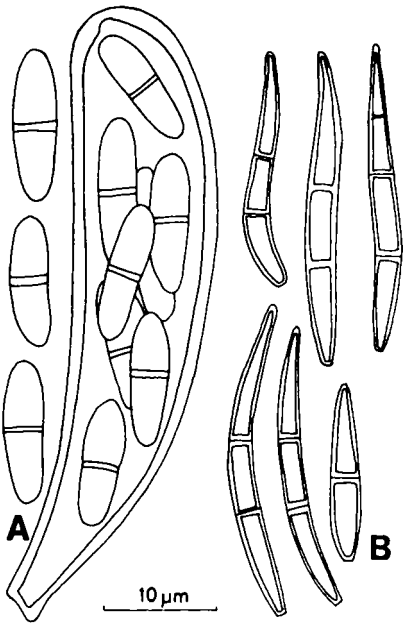


Fig. 135. *Mycosphaerella populorum*. A, ascus and ascospores; B, conidia.

16 µm. Ascospores fusiform, slightly unequally septate, 22-32 × 6-7 µm.

Pycnidia amphigenous on living leaves in the summer, irregularly scattered to aggregated in lesions, up to 167 µm broad. Conidia filiform, straight or curved, hyaline, 2-5 septate, 45-80 × 3-4.5 µm.

Spermogonia associated with pycnidia, up to 112 µm broad. Spermatia hyaline, one celled, rod-shaped, 6.5-8 × 1-1.5 µm.

On *Populus tacamahaca*. U.S.A.

M. populorum Thompson, *Phytopathology* **31:** 246, 1941 (Fig. 135).

Anamorph: *Septoria musiva* Peck, *Ann. Rep. N.Y. St. Mus.* **35:** 138, 1884.

Pseudothecia amphigenous, scattered or grouped in dark areas, up to 145 µm broad. Asci 35-70 × 9-16 µm. Ascospores fusoid to narrowly elliptic, 12-28 × 3.5-6 µm.

Pycnidia up to 120 µm broad. Conidia cylindrical, 1-4 septate, 28-54 × 3.5-4 µm.

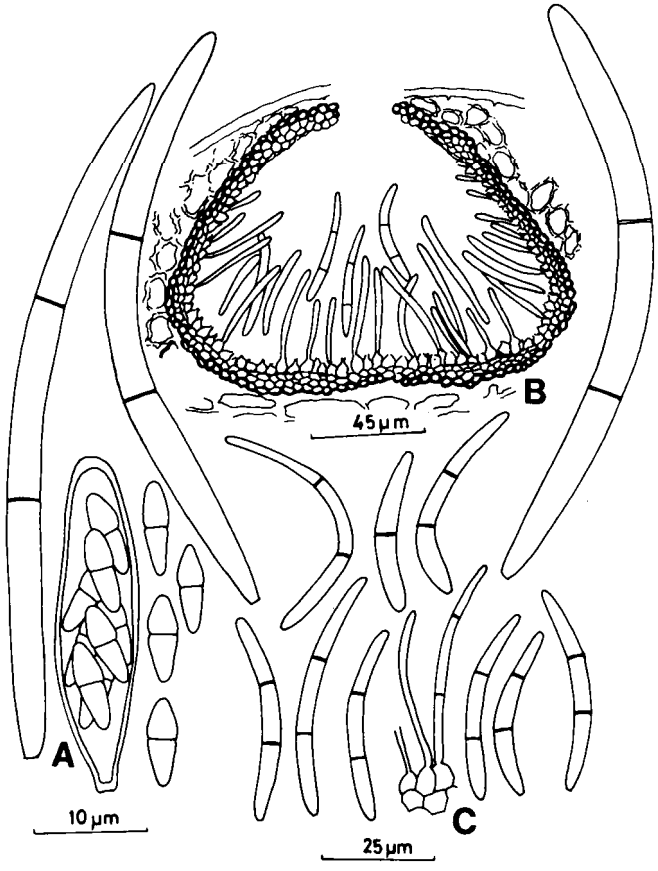


Fig. 136. *Mycosphaerella pyri.* A, ascus and ascospores; B, v.s. pycnidium; C. conidiogenous cells and conidia.

Spermogonia up to 80 µm broad. Spermatia hyaline, one celled, 4-6.5 × 1.5 µm.

On overwintered leaves of *Populus balsamifera* and other *Populus* spp. Canada, U.S.A.

M. pyri (Auersw.) Boerema, *Neth. J. Pl. Path.* **76:** 166, 1970 (Fig. 136).

Sphaerella pyri Auersw. in Gonnerm. & Rabenh., *Mycol. europ.* **5/6:** 11, 1869. *Mycosphaerella sentina* (Fr.) Schröet., *Krypt.-Fl. Schles.* **3:** 334, 1894. (misapplied).

Anamorph: *Septoria pyricola* (Desm.) Desm., *Annls Sci. Nat.* **14:** 114, 1850 (as '*piricola*').

Depazea pyricola Desm., *Fl. Crypt. N. France* (ed. 1) Fasc. **15**, No. 721, 1834.

Pseudothecia aggregated in spots, up to 150 μm broad. Asci 35-50 × 7-10 μm. Ascospores 7-9 × 3-4 μm with an upper cell broader and smaller than the lower cell.

Pycnidia mostly epiphyllous on irregular, grey white spots with a brown border. Conidia subcylindrical, curved, pale olivaceous, 1-2 septate, 40-58 × 3-5 μm, tapering slightly towards the apex.

On leaves of *Pyrus*. (Leaf-fleck fungus of pear). India, Europe, Nepal, U.S.A.

Mycosphaerella species with Stigmina anamorph

Stigmina Sacc.

Mycelium mostly immersed. Stroma always present. Conidiophores usually short, closely packed together forming pulvinate sporodochia, mostly simple, straight or flexuous, subhyaline to brown, smooth to verruculose. Conidiogenous cells integrated, terminal, monoblastic, percurrent, cylindrical, doliiform or lageniform, annellidic. Conidia solitary, dry, acrogenous, simple, clavate, cylindrical, rounded at the apex, truncate at the base, ellipsoidal or obclavate, occasionally rostrate, subhyaline to dark brown, smooth, rugose, verrucose or echinulate, 1 or more transversely septate, sometimes with 1 or more oblique or vertical septa in some of the cells (Ellis, 1971).

Key to Mycosphaerella species with Stigmina anamorph

Ascospores 14.5-17 × 3.5-4 μm, conidia 0-6 septate, 21-68 × 3-5 μm, on *Yucca*. ..... *M. deightonii*

Ascospores 11-16 × 3.5-6 μm, conidia 1-8 septate, 15-40 × 7-10 μm, on *Platanus*..... *M. stigmina-platani*

M. deightonii Morelet, *Bull. Soc. Sci. nat. Archéol. Toulon Var.* **205:** 9, 1973 (Fig. 137).

Anamorph: *Stigmina concentrica* (Cooke & Ell.) Deighton, *Trans. Br. mycol. Soc.* **61:** 107, 1973.

Cercospora concentrica Cooke & Ell., *Grevillea* **5:** 90, 1877.
Cylindrosporium angustifoliae Ell. & Kellerm., *J. Mycol.* **2:** 81, 1886.

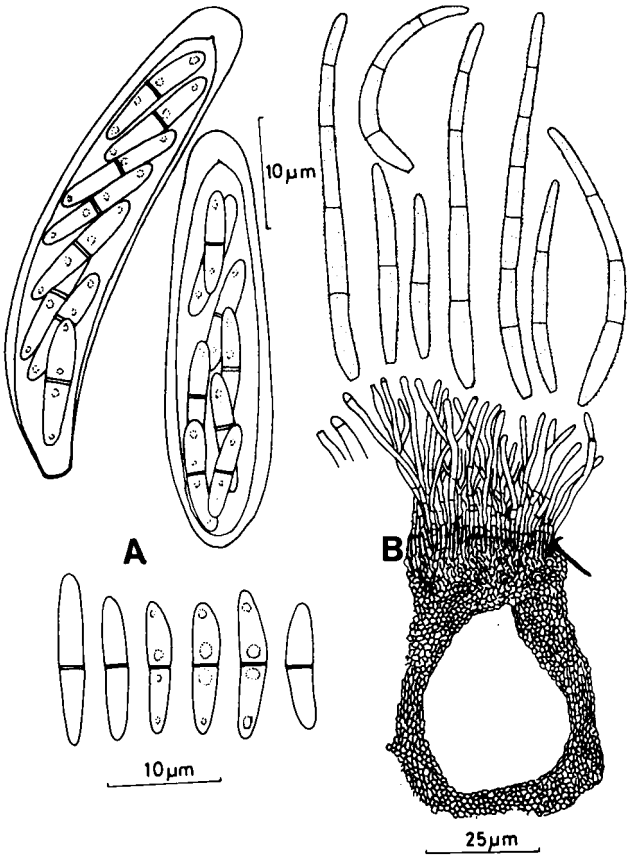


Fig. 137. *Mycosphaerella deightonii* (type). A, asci and ascospores; B, conidiophores and conidia.

Cylindrosporium ? yuccae Montemartini, *Riv. Pat. veg. Pavia* **7**: 231, 1915.

Pseudothecia embedded within the mass of ascending conidiogenous hyphae in the stroma, up to 120 µm broad. Asci 45-52 × 8-9 µm. Ascospores 14.5-17 × 3.5-4 µm.

Spermogonia embedded within the stroma. Spermatia rod-shaped, hyaline, one celled, 2.5-3.5 × 0.75 µm.

Conidial leaf spots elliptic, 1-4 µm long, visible on both surfaces, with a greyish brown centre surrounded by a brown margin. Caespituli amphigenous. Mycelium internal. Stromata deep-seated, consisting of a basal prosenchymatous stratum of interwoven hyphae surmounted by a palisade like mass of very numerous closely packed, parallel, closely sep-

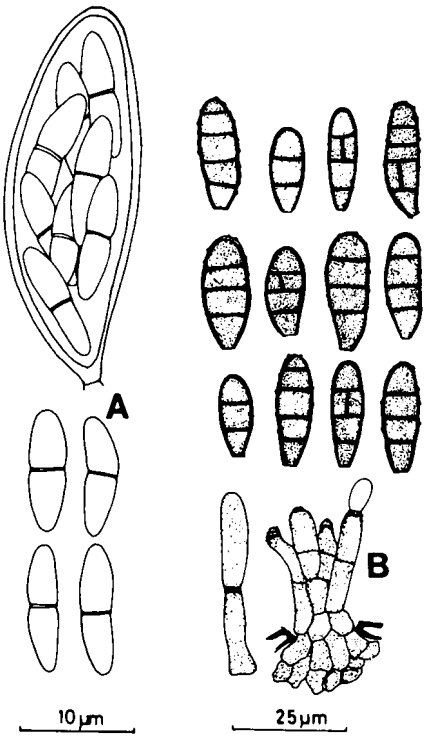


Fig. 138. *Mycosphaerella stigmina-platani* (type). A, ascus and ascospores; B, conidiophores and conidia.

tate, pale olivaceous hyphae (appearing dark brown coloured in mass), which are several times branched with conidiogenous cells at their distal ends. Conidia pale olivaceous, thin-walled, very minutely and closely asperulate, subcylindric, slightly narrower near the obtuse apex, the basal cell slightly narrowed towards the unthickened slightly convex hilum, 0-6 septate, not constricted, 21-68 × 3-5 µm.

On *Yucca*. Italy, Switzerland, U.S.A, USSR.

M. stigmina-platani Wolf, *Mycologia* **30:** 60, 1938 (Fig. 138).

Anamorph: *Stigmina platani* (Fuckel) Sacc., *Syll. Fung.* **4:** 394, 1886.

Stigmella platani Fuckel, *Bot. Zt.* **29:** 27, 1871.

Pseudothecia hypophyllous on overwintered leaves, scattered often in blackened areas, up to 100 μm broad. Asci 25-70 × 8-16 μm. Ascospores obovoid, straight or inequilateral, 11-16 × 3.5-6 μm.

Spermogonia hypophyllous, up to 65 μm broad. Spermatia hyaline, oblong to rod-shaped, one celled, 2-3 × 1 μm.

Conidial state parasitic on leaves. Conidiophores fasciculate, cylindrical, erumpent through the stomata. Conidia hyaline to dark olivaceous brown, oblong, elliptic, 1-8 septate, 15-40 × 7-10 μm with a thick, dark, coarsely roughened wall.

On *Platanus occidentalis*. U.S.A.

Mycosphaerella species with Ramularia anamorph

Ramularia Unger

Mycelium mostly immersed. Stromata present. Conidiophores solitary or fasciculate, emerging through the stomata or from hyphae and sterile ascocarps, hyaline to pale brown, septate or not, simple or branched, smooth. Conidiogenous cells integrated, sympodial, polyblastic, cylindrical, cicatrized. Conidial scars thickened and conspicuous. Conidia dry, in branched or unbranched chains, acropleurogenous, hyaline or pale brown, cylindrical with rounded ends, ellipsoidal or broadly fusiform, smooth, 0-multiseptate.

Key to Mycosphaerella species with Ramularia anamorph

Ascospores usually not exceeding 16 μm in length, conidia 0-3 septate..... 1

Ascospores exceeding 16 μm in length, conidia 0-3 septate..... 4

1. Conidia non septate or rarely septate.....2

   Conidia 0-3 septate..... 3

2. Ascospores 7.5-10 × 2-4 μm, conidia 2-6 × 2-3.5 μm.... *M. nigromaculans*

   Ascospores 7-14 × 2-4 μm, conidia 4-20 × 2-3.5 μm..... *M. punctiformis*

3. Ascospores 11-14.5 × 2-3 μm, conidia 14-45 × 2-3 μm..... *M. fragariae*

   Ascospores 12-16 × 3-4 μm, conidia 14-30 × 4-5 μm..... *M. areola*

4. Conidia 0-1 septate..... 5

   Conidia 0-3 septate, 15-30 × 3-7 μm, ascospores 12-22 × 4-5 μm..... *M. superflua*

5. Ascospores 11-15 × 3.5-4.5 μm, conidia 7-18 × 3-5.5 μm..... *M. digitalis-ambiguae*

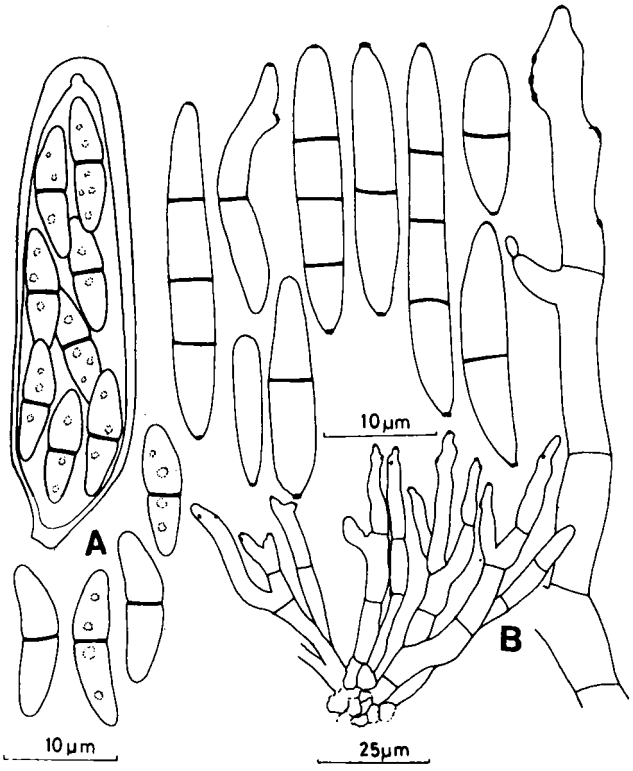


Fig. 139. *Mycosphaerella areola.* A, ascus and ascospores; B, conidiophores and conidia.

Ascospores 14-20 × 3.5-5 µm, conidia 20-40 × 3-5 µm..... *M. hieracii*

Ascospores 21-27 × 7-8 µm, conidia 12-45 × 5-10 µm..... *M. chamaenerii*

M. areola Ehrlich & Wolf, *Phytopathology* **22:** 238, 1932 (Fig. 139).

Anamorph: *Ramularia gossypii* (Speg.) Cif., *Atti Ist. bot. Univ. Pavia* ser. 5, **19:** 124, 1962.

Cercosporella gossypii Speg., *Ann. Soc. Cient. Arg.* **22:** 208, 1886.
Ramularia areola Atk., *Bot. Gaz.* **15:** 168, 1890.
Septocylindrium areola (Atk.) Pounds & Clem., *Minn. bot. Stud.* **1:** 651, 1896.
Symphyosira areola (Atk.) Saw., *Spec. Publ. Coll. Agric. Nat. Taiwan Univ.* **8:** 232, 1959.
Septocylindrium gossypii (Speg.) Subram., *Hyphomycetes:* 309, 1971.

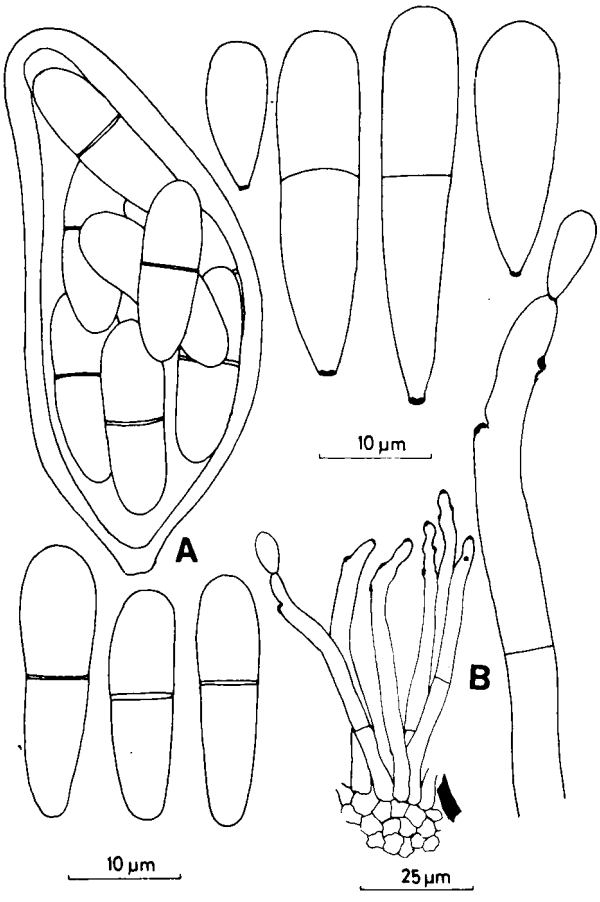


Fig. 140. *Mycosphaerella chamaenerii.* A, ascus and ascospores; B, conidiophores and conidia.

Pseudothecia hypophyllous on dead leaves, aggregated in spots, up to 80 µm broad. Asci 35-40 × 6-8 µm. Ascospores oblong, slightly unequally septate, not or slightly constricted at the septum, 12-16 × 3-4 µm.

Spermogonia densely aggregated, up to 75 µm broad. Spermatia hyaline, one celled, rod-shaped, 2.5-4 × 0.5-2 µm.

Conidial state on living leaves. Conidiophores fasciculate, simple or branched at the base, emerging through the stomata, 25-75 × 4.5-7 µm. Conidia hyaline, 1-3 septate, solitary or in short chains, 14-30 × 4-5 µm.

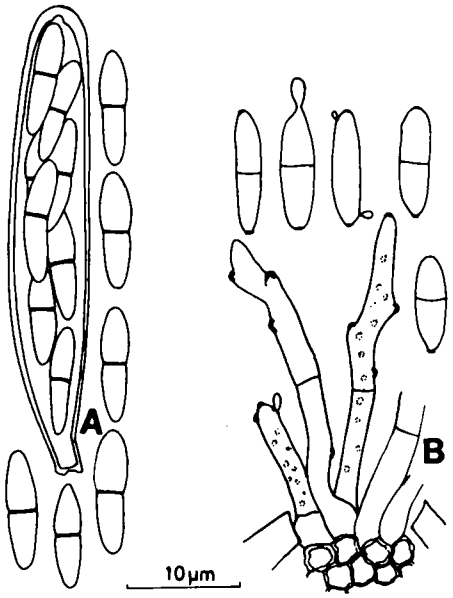


Fig. 141. *Mycosphaerella digitalis-ambiguae* (type). A, ascus and ascospores; B, conidiophores and conidia.

On leaves of *Gossypium*. The fungus causes the areolate mildew in cotton. The pseudothecia are formed on decaying leaves in the spring, and the disease occurs in summer on the older leaves. Cosmopolitan.

M. chamaenerii Savile, *Can. J. Bot.* **40:** 1388, 1962 (Fig. 140).

Anamorph: *Ramularia chamaenerii* Rostrup, *Bot. Tiddskr.* **14:** 229, 1885.

Pseudothecia up to 120 µm broad. Asci 45-60 × 20-28 µm. Ascospores 21-27 × 7-8 µm.

Conidiophores hypophyllous on living leaves also growing from pseudothecia, fasciculate. Conidia 0-1 septate, smooth to minutely verruculose, 12-45 × 5-10 µm.

On *Epilobium latifolium*. Canada, Iceland.

M. digitalis-ambiguae von Arx, *Sydowia* **3:** 92, 1949 (Fig. 141).

Anamorph: *Ramularia digitalis-ambiguae* von Arx, *Sydowia* **3:** 93, 1949.

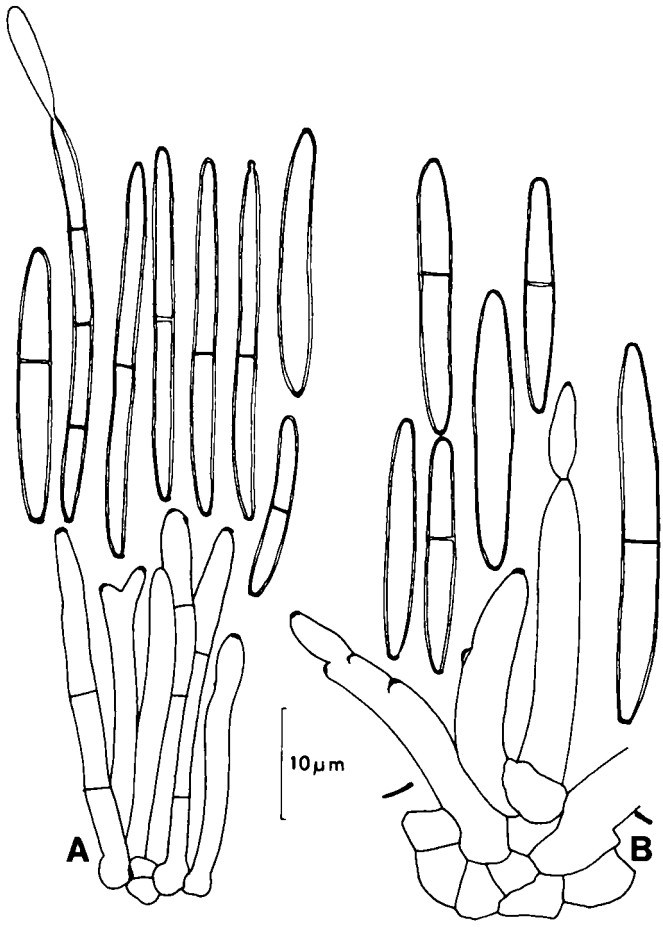


Fig. 142. *Mycosphaerella fragariae.* A, conidiophores and conidia. *M. hieracii.* B, conidiophores and conidia.

Spermatial state: *Asteromella digitalis-ambiguae* von Arx, *Sydowia* **3**: 94, 1949.

Pseudothecia mostly solitary, scattered, amphigenous, mostly hypophyllous, up to 110 µm broad. Asci 32-42 × 7-9 µm. Ascospores oblong clavate, constricted at the septum, 11-15 × 3.5-4.5 µm.

Spermogonia amphigenous, mostly hypophyllous. Spermatia rod-shaped, hyaline, one celled, 2-3.5 × 1 µm.

Conidial spots irregular, dark yellow, purple to dark brown. Conidiophores hypophyllous arising from subepidermal stroma, fasciculate, 15-28 × 2.5-4 μm. Conidia in short chains, ellipsoid to short cylindric, ends rounded, 0-1 septate, 7-18 × 3-5.5 μm.

On *Digitalis ambigua*. Switzerland.

M. fragariae (L.R. Tul.) Lindau in Engler & Prantl, *Nat. Pflanzenfam.* **1:** 424, 1897 (Fig. 142A).

Sphaeria fragariae L.R. Tul., *Ann. Sci. nat. ser.* 4, **5:** 112, 1856.
Stigmatea fragariae (L.R. Tul.) Tul., *Sel. Fung. Carp. 2:* 288, 1863.
Sphaerella fragariae (L.R. Tul.) Sacc., *Syll. Fung.* **1:** 505, 1882.

Anamorph: *Ramularia brunnea* Peck, *Rep. N.Y. St. Mus.* **30:** 56, 1876.

Ramularia tulasnei Sacc., *Syll. Fung.* **4:** 203, 1886.
(after Barr, 1972).

Leaf spots grey to whitish pale brown with a purplish or brown margin. Pseudothecia mostly epiphyllous, scattered or aggregated, up to 160 μm broad. Asci 50-70 × 9.5-13 μm. Ascospores fusoid, straight, 11-14.5 × 2-3 μm.

Conidiophores fasciculate from subepidermal stroma or from the apex of pseudothecia. Conidia solitary or in chains, 0-3 septate (mostly 1 septate), 14-45 × 2-3 μm.

On *Fragaria*. Cosmopolitan causes the leaf blight of strawberries. (Sivanesan & Holliday, CMI Descr. 708, 1981).

M. hieracii (Sacc. & Briard.) Jaap, *Verh. Bot. Ver. Prov. Brand.* **50:** 36, 1908 (Fig. 142B).

Sphaerella nebulosa (Pers.) Sacc. var. *hieracii* Sacc. & Briard in Briard, *Rev. Mycol.* **7:** 208, 1885, non *S. hieracii* Cooke & Massee, 1886.
Sphaerella prignitziensis Kirschst., *Krypt.-Fl. M. Brand.* **7:** 334, 1938.

Anamorph: *Ramularia hieracii* (Bäumler) Jaap, *Verh. Bot. Ver. Prov. Brand.* **50:** 36, 1908.

Ramularia filaris Fres. var. *hieracii* Bäumler, *Verh. Zool. bot. Ges. Wien* **41:** 673, 1891.
Ramularia conspicua H. Sydow, *Annls mycol.* **1:** 538, 1903.

Pseudothecia up to 120 μm broad. Asci 45-55 × 8-10 μm. Ascospores 14-18(20) × 3.5-5 μm.

Conidia 0-1 septate, 20-40 × 3-5 μm.

On *Hieracium* spp. Europe.

Klebahn (1918) has proved the genetic connection between the ascus and conidial state.

M. nigro-maculans Shear in Shear, Stev. & Bain, *Tech. Bull. U.S. Dept. Agric.* **258:** 11, 1931.

Anamorph: *Ramularia nigro-maculans* Shear.

Pseudothecia scattered in black spots on stems, leaves and fruits, up to 105 μm broad. Asci 23-35 × 3-4 μm. Ascospores ellipsoidal, 7.5-10 × 2-4 μm, with a slightly broader upper cell.

Single ascospore isolates produced the *Ramularia* state in culture (Shear *et al.*, 1931) loc. cit. Conidiophores simple or branched, 2-3 μm thick. Conidia hyaline to pale olivaceous brown, in short chains, globose to elliptic, one celled, 2-6 × 2-3.5 μm.

On *Vaccinium intermedium, V. macrocarpum* associated with black spot disease. U.S.A.

M. punctiformis (Pers.: Fr.) Starb., *Beih. K. svenksa Vetensk Akad. Handl.* **15:** 9, 1889 (Fig. 101B).

Sphaeria punctiformis Pers.: Fr., *Syst. mycol.* **2:** 525, 1823.
Ramularisphaerella punctiformis (Pers.:Fr.) Kleb., *Ber. dt. bot. Ges.* **36:** 57, 1919.

Anamorph: *Ramularia* sp.

Pseudothecia scattered or aggregated, amphigenous, mostly hypophyllous, upto 120 μm broad. Asci 27-50 × 5-8 μm. Ascospores oblong or obovate, sometimes inequilateral, 7-14 × 2-4 μm with a shorter and broader upper cell.

Conidia hyaline, oblong, mostly one celled, 4-20 × 2-3.5 μm, formed in short chains. Brefeld & Tavel (1891) and Klebahn (1918) have obtained the conidial state in culture along with an *Asteromella* spermatial state. Tomilin (1979) has included several other names as synonyms and it may be a collective name for several entities (Barr, 1972).

On overwintered leaves of various deciduous trees and shrubs. Cosmopolitan.

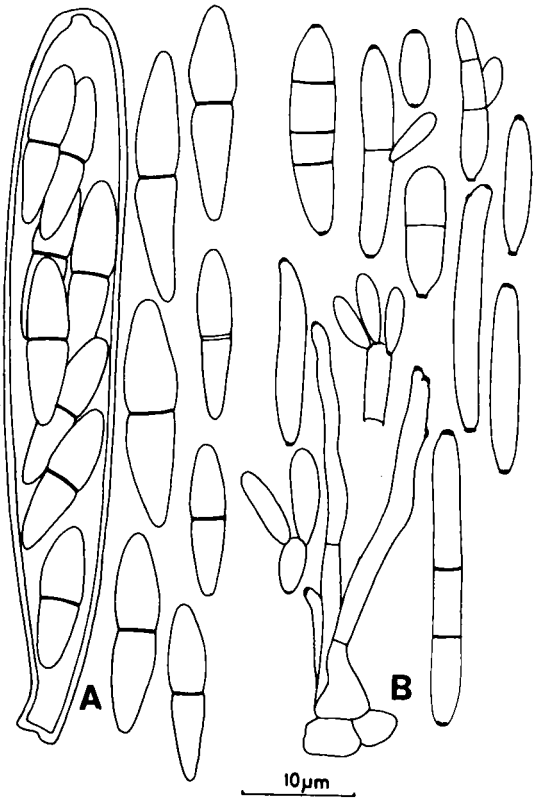


Fig. 143. *Mycosphaerella superflua*. A, ascus and ascospores; B, conidiophores and conidia.

M. superflua (Auersw.) Petrak, *Annls mycol.* **38:** 235, 1940 (Fig. 143).

Sphaeria superflua Auersw., *Fuckel Fungi Rhenani* No. 888, 1863.
Sphaerella superflua (Auersw.) Auersw. in Gonnerm. & Rabenh., *Mycol. europ.* **5/6:** 14, 1869.
Didymella superflua (Auersw.) Sacc., *Michelia* **2:** 316, 1881.

Anamorph: *Ramularia urticae* Ces. in Fres., *Beitr. Mykol.* **3:** 89, 1863.

Cylindrosporium urticae (Ces.) Schröeter, *Krypt.-Fl. Schles.* **2:** 492, 1897.
Septocylindrium urticae (Ces.) Subram., *Hyphomycetes:* 310, 1971.

Pseudothecia subepidermal, upto 180 µm broad. Asci 55-70 × 7-10 µm. Ascospores 12-18(22) × 4-5 µm, slightly unequally septate.

Conidial spots amphigenous, irregular, coalescing. Colonies amphi-

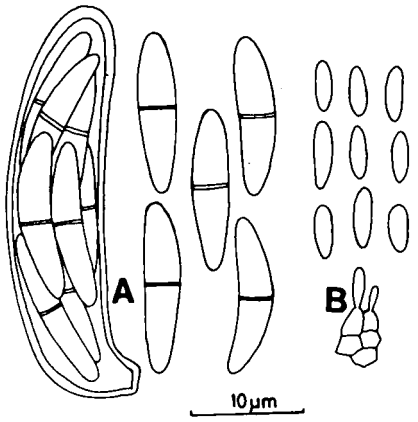


Fig. 144. *Mycosphaerella brassicicola*. A, ascus and ascospores; B, conidiogenous cells and conidia.

genous, whitish. Conidiophores mostly hypophyllous, fasciculate, hyaline, denticulate above, non septate, simple, rarely branched, 30-85 × 2-4 µm. Conidia cylindric-fusoid, 0-3 septate, hyaline, in long chains, 15-30 × 3-7 µm, apiculate at both ends.

On leaves of *Urtica dioica, U. urens*. Europe, India, N. America.

Mycosphaerella species with other types of anamorph

M. brassicicola (Duby) Lindau in Engler & Prantl, *Nat. Pflanzenfam.* **1:** 424, 1897 (Fig. 144).

Sphaeria brassicicola Duby, *Bot. Gall.* **2:** 712, 1830 (as '*brassicaecola*').
Dothidea brassicicola Desm., *Ann. Sci. Nat.* **17:** 113, 1842.
Sphaeria brassicae Berk. & Br., *Ann. Mag. Nat. Hist.* **9:** 384, 1852.
Sphaerella brassicicola (Duby) Ces. & de Not., *Comm. Soc. Critt. Ital.* **4:** 238, 1863.

Anamorph: *Asteromella brassicae* (Chev.) Boerema & van Kest., *Persoonia* **3:** 18, 1964. Spermogonial state.

Asteroma brassicae Chev., *Fl. gen. Environs de Paris* **1:** 449, 1826.
Phoma siliquastrum Desm., *Ann. Sci. nat. Bot.* ser. 3, **11:** 280, 1849.
Sphaeria (Depazea) brassicae Currey, *Trans. Linn. Soc. Lond.* **22:** 334, 1859.
Phyllosticta napi Sacc., *Michelia* **1:** 532, 1879.
Phyllosticta brassicicola McAlp., *Bull. Vict. agric. Dept.*: 27, 1901 (as '*brassicaecola*')

Phyllosticta brassicina Sacc., *Annls mycol.* **11:** 16, 1913.
Phyllosticta brassicicola Grove, *J.R. hort. Soc.* **40:** 76, 1914.
Asteromella brassicina (Sacc.) Rupprecht, *Sydowia* **13:** 11, 1959.

Pseudothecia mostly on leaves and sometimes on pods and stems, upto 130 μm broad. Asci 30-45 × 12-18 μm. Ascospores cylindrical, 18-23 × 3-5 μm, with rounded ends.

Spermogonia develop first on the spots, solitary or aggregated upto 200 μm broad. Spermatia cylindrical, hyaline, one celled, 3-5 × 1 μm.

On *Brassica,* widespread, generally restricted to cool, moist regions. This fungus causes a typical leaf spot known as ring spot of *Brassica* spp. especially on varieties of *B. oleracea.* Apart from the leaves, all other aerial parts of the plant may be affected. For description of disease symptoms refer to Weimer (1926). For illustrations and brief description of the fungus, disease and control see Punithalingam & Holliday (1975).

M. caricae H. & P. Sydow, *Annls. mycol.* **11:** 403, 1913 (Fig. 145).

Sphaerella caricae Maubl., *Bull. Soc. mycol. Fr.* **29:** 358, 1913.
Mycosphaerella caricae (Maubl.) Hansf., *Proc. Linn. Soc. Lond.* **153:** 22, 1941.

Anamorph: *Phoma caricae-papayae* (Tarr) Punith., *Trans. Br.mycol.Soc.* **75:** 340, 1980.

Ascochyta caricae-papayae Tarr, *The Fungi and Plant Diseases of Sudan:* 53, 1955.
Ascochyta caricae Pat., *Bull. Soc. mycol. Fr.* **7:** 178, 1891, non Rabenh., 1851.

Pseudothecia up to 180 μm broad. Asci 28-53 × 6.5-13 μm. Ascospores constricted at the septum, upper cell larger and wider than the lower, 7.5-15 × 3-5 μm, may develop additional septa after discharge.

Pycnidia immersed to erumpent up to 220 μm broad. Conidia hyaline, ovoid, ellipsoidal, mostly 1 septate, 7-12 × 3-4 μm.

On *Carica papaya.* Causes fruit and trunk rot, leaf spot and stem end rot. India, Hawaii (Chowdhury 1950; Chau & Alvarez 1979; Ullasa, Sohi & Ganapathy, 1974).

M. convallariae McKeen & Zimmer, *Can. J. Bot.* **42:** 667, 1964.

Anamorph: *Ascochyta majalis* Massalonga, *Atti Reale Inst. veneto Sci. Lettere Arti* **59:** 684, 1899-1900.

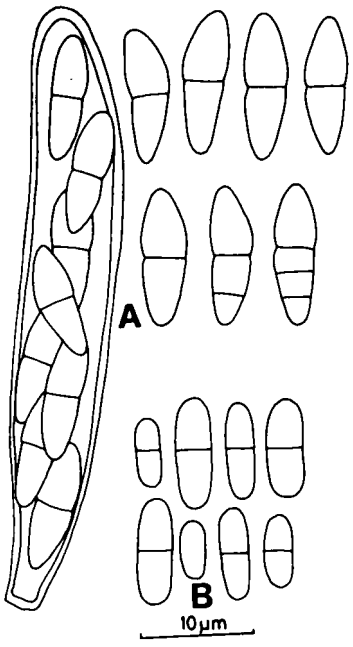


Fig. 145. *Mycosphaerella caricae.* A, ascus and ascospores; B, conidia.

Pseudothecia epiphyllous, subepidermal, erumpent, scattered in the central clear area of lesion, up to 185 µm broad. Asci clavate 55-96 × 11-18 µm. Ascospores biseriate in the ascus, ovoid oblong, 1 septate, rarely 2 septate, 13-22 × 5-8 µm.

Pycnidia black, immersed, globose, scattered in the clear central area of lesion, up to 190 µm broad. Conidia hyaline 1-2 septate, 15-25 × 3.5-6 µm.

On living leaves of *Convallaria majalis;* causing lily of the valley leaf blotch (Jenkins, 1942). Austria, Canada, Italy, U.S.A.

M. holci Tehon, *Mycologia* **29:** 434, 1937 (Fig. 146).

Anamorph: *Phoma sorghina* (Sacc.) Boerema, Dorenb. & v. Kest., *Persoonia* **7:** 134, 1973.

Phyllosticta sorghina Sacc., *Michelia* **1:** 140, 1878.
Phyllosticta sacchari Speg., *Revta Fac. Agron. Univ. nat. La Plata* **2:** 239, 1896.
Phoma insidiosa Tassi, *Boll. R. Orto bot. Siena* **1:** 8, 1898.
Phyllosticta setariae Ferr., *Malpighia* **16:** 18, 1902.

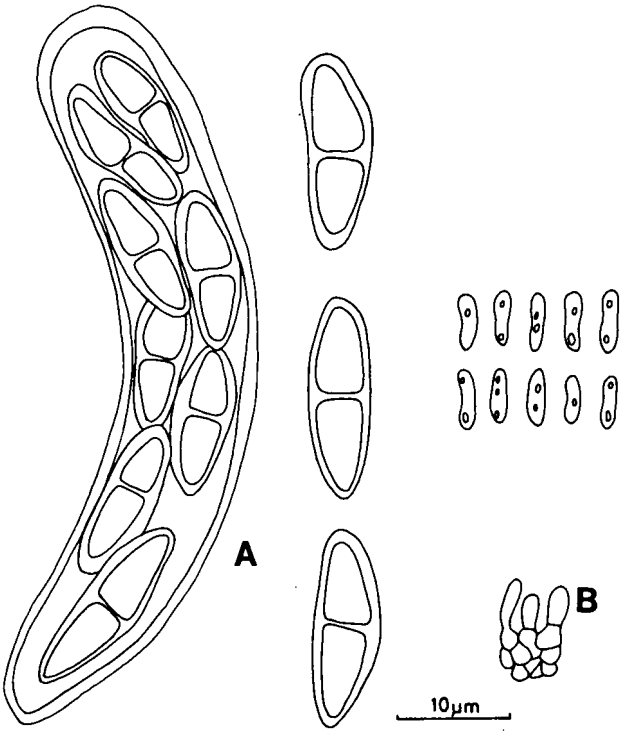


Fig. 146. *Mycosphaerella holci.* A, ascus and ascospores; B, conidiogenous cells and conidia.

For other synonyms refer to Boerema, Dorenbosch & van Kesteren (1965, 1968, 1971, 1973, 1976).

Leaf spots tan to straw coloured. Pseudothecia amphigenous, mostly hypophyllous, up to 100 µm broad. Asci 30-52 × 8-12 µm. Ascospores oblong to ovoid, constricted at the septum, 12-18 × 4.5-6.5 µm, surrounded by a thin gelatinous sheath.

Pycnidia scattered in the same spots among pseudothecia, up to 140 µm broad. Conidiogenous cells hyaline, short, obpyriform, arising from the cells lining the inside of the pycnidium. Conidia hyaline, one celled, ellipsoid, usually biguttulate, 5-8 × 2-2.5 µm. Simple chlamydospores and dictyochlamydospores are often formed in culture and the conidia may become one septate on germination.

On *Chloris, Leucospermum, Macroptilium, Oryza, Panicum, Pennisetum, Phonus, Saccharum, Setaria, Triticum, Zea.* The fungus causes spots on leaves, glumes, grains and a brown canker of stems. Anahosur

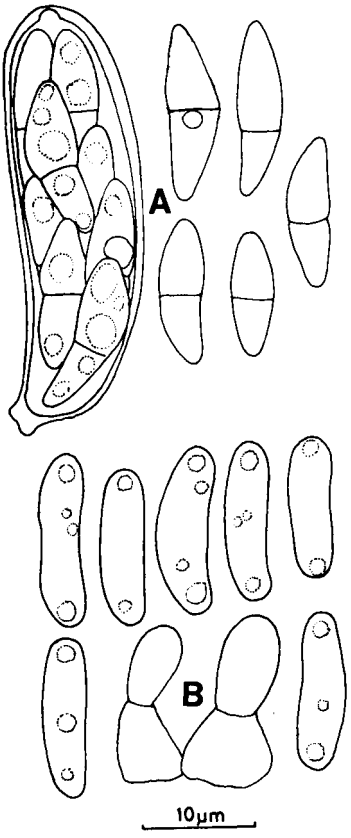


Fig. 147. *Mycosphaerella zeae-maydis* (type). A, ascus and ascospores; B, conidiogenous cells and conidia.

& Sivanesan (1978) have given a full description, illustration and brief notes on biology, control and transmission of this species. The genetic connection between the two states has yet to be established in culture. Worldwide, especially on the above mentioned crops.

M. zeae-maydis Mukunya & Boothroyd, *Phytopathology* **63:** 530, 1973 (Fig. 147).

Anamorph: *Phyllosticta maydis* Arny & Nelson, *Phytopathology* **61:** 1171, 1971.

Pseudothecia up to 200 µm broad. Asci 40-65 × 9-12 µm. Ascospores 13-20 × 5-6 µm with a longer broader upper cell.

Pycnidia immersed in necrotic tissues of the leaf, up to 150 μm broad. Conidia hyaline, one celled, biguttulate, 8-20 × 3-7 μm. The anamorph is more appropriately placed in the genus *Phoma* than in *Phyllosticta.*

On *Zea mays* causing yellow leaf blight. Canada, U.S.A.

It differs from *M. zeae* (Sacc.) Woronow. (= *M. zeicola* Stout) and *M. maydis* (Pass.) Lobik in the size of the pseudothecia and in the morphology of the ascospores. For comparison with these species refer to *Phytopathology* **63:** 530, 1973.

PRINGSHEIMIA Schulzer, *Verh. K.K. Zool.-Bot. Ges. Wien* **16:** 57, 1866.

Pleosphaerulina Pass., *Atti Reale Accad. Lincei, Rendiconti Cl. Sci. Fis.* **7:** 46, 1891.
Schizostege Theiss., *Annls mycol.* **14:** 415, 1916 (1917) non Hillebrand 1888.
Phaeodothiora Petrak, *Sydowia* **2:** 82, 1948.
Saccothecium sensu Barr, *Contr. Univ. Mich. Herb.* **9:** 577, 1972 (non Fries, 1849).

Type sp.: *P. sepincola* (Fr.) Höhnel, *Annls mycol.* **18:** 97, 1920.

Anamorphs: *Hormonema*-like state produced in culture and *Dothichiza* pycnidia.

Mycelium brown, septate, penetrating into the plant tissues. Pseudothecia immersed, subepidermal, becoming erumpent, usually in short rows, unilocular, black, depressed globose, with a papillate erumpent ostiole. The thick wall is composed of several layers of darkened, thick-walled angular to polygonal cells on the outside and compressed cells toward the interior lining the cavity. Asci arising from a central hemispherical or cylindrical basal cushion of hyaline to brown cells, numerous, oblong clavate to clavate, stalked, 8 spored, rounded at the apex and thick-walled above. Ascospores overlapping, hyaline (olivaceous or dark brown in *Phaeodothiora),* transversely multiseptate, with vertical septum in one or more of the central cells, constricted at the primary septum, straight to inequilateral, guttulate, smooth, enlarged above.

Hormonema: Conidia hyaline or brown, one celled, ovoid, budding from ascospores or other conidia and from the inner wall cells of small pycnidia.

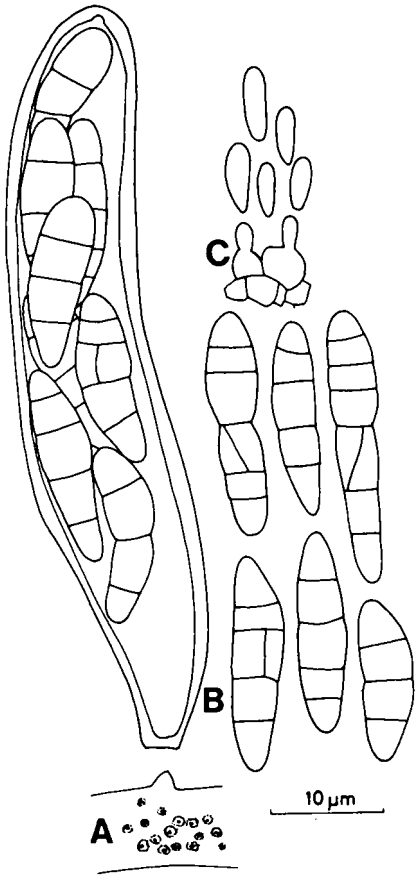


Fig. 148. *Pringsheimia chamaecyparidis* (type). A, habit on branch; B, ascus and ascospores; C, conidiogenous cells and conidia.

Key to species of Pringsheimia with anamorphs

Asci 33-70 × 13-16, ascospores 16-20 × 5.5-7 µm..... *P. sepincola*

Asci 30-50 × 11-16, ascospores 16-24 × 5.5-7 µm..... *P. chamaecyparidis*

Five species known (Froidevaux, 1972) and two with anamorphs.

P. chamaecyparidis Froid., *Nova Hedwigia* **23:** 713, 1972 (Fig. 148).

Anamorph: *Dothichiza* sp.

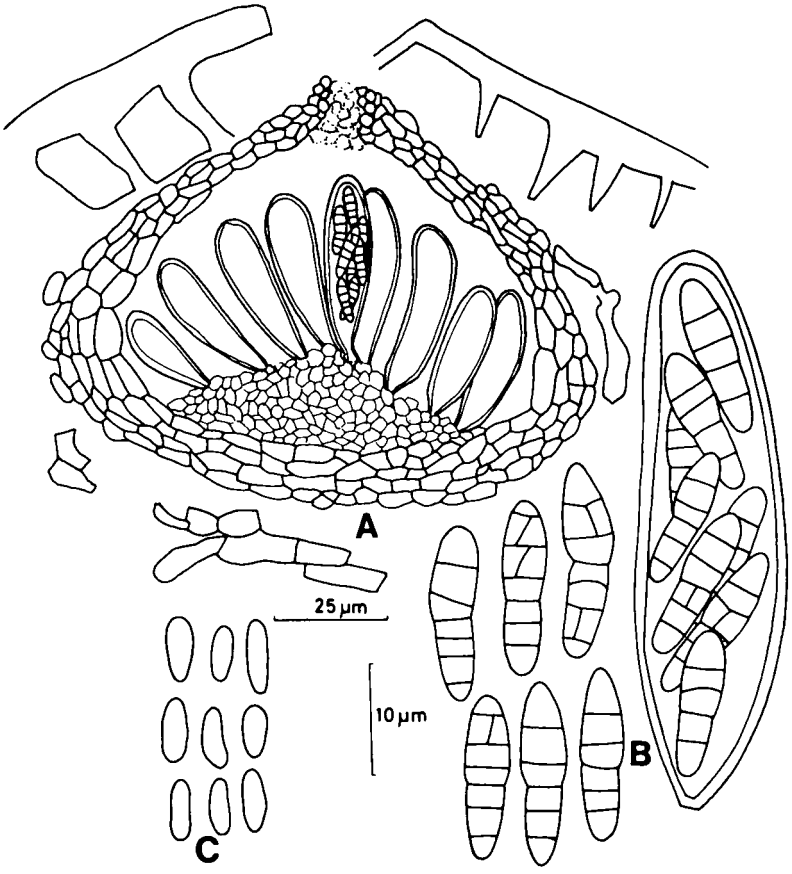


Fig. 149. *Pringsheimia sepincola*. A, v.s. pseudothecium; B, ascus and ascospores; C, conidia.

Pseudothecia 200-300 µm broad. Asci ellipsoid to somewhat clavate, 30-50 × 11-16 µm. Ascospores clavate, constricted in the middle, 3-6 transversely septate with rarely few vertical septa, 16-24 × 5.5-7 µm.

Conidia ovoid to oblong, hyaline, aseptate, 6-12 × 3-4 µm.

On *Chamaecyparis lawsoniana*. France.

P. sepincola (Fr.) Höhnel, *Annls mycol.* **18:** 97, 1920 (Fig. 149).

Sphaeria sepincola Fr., *Syst. mycol.* **2:** 498, 1823.
Saccothecium sepincola (Fr.) Fr., *Summa veg. Scand.:* 398, 1849.
Pringsheimia rosarum Schulzer, *Ver. K.K. Zool.-Bot. Ges. Wien* **16:** 57, 1866.

Sphaeria rosicola Fuckel, *Symb. mycol.:* 114, 1870.
Physalospora rosicola (Fuckel) Sacc., *Syll. Fung.* **1:** 435, 1882.
Sphaerulina sepincola (Fr.) Starb., *Bot. Not.* **1890:** 117, 1890.
Pleosphaerulina rosicola Pass., *Atti Reale Accad. Lincei, Rend. Cl. Sci. Fis.* **7:** 46, 1891.
Schizostege rosicola (Fuckel) Theiss., *Annls mycol.* **14:** 415, 1916.
Pleosphaerulina sepincola (Fr.) Rehm in Höhnel, *Annls mycol.* **18:** 96, 1920.

Pseudothecia up to 200 μm broad. Asci 33-70 × 13-16 μm. Ascospores elliptic cylindric, 3-7 (usually 5) septate, strongly constricted at the mid septum, occasionally with a vertical septum in some of the central cells, 16-20 × 5.5-7 μm.

Dothichiza conidia 6-9 × 2.5-4 μm; *Hormonema* conidia 6-10 × 2.5-4 μm. According to Hermanides-Nijhof (1977) the *Hormonema* conidia are indistinguishable from *H. dematioides.*

On dead twigs of *Rosa, Cornus, Rubus.* Canada, Europe, Pakistan, U.S.A.

SCIRRHIA Nits. ex Fuckel, *Symb. mycol.:* 220, 1870.

Type sp.: *S. rimosa* (Alb. & Schw.) Nits., *Symb. mycol.:* 221, 1870.

Anamorphs: *Dothistroma* Hulbary and *Lecanosticta* H. Sydow.

Spermatial state: *Asteromellopsis* Hess & E. Müller

Stromata subepidermal to erumpent, elongated, depressed globose, rounded, unilocular or with locules in many rows, opening by an apical pore. The stromatic wall is composed of vertically-orientated rows of brown to reddish brown cells of textura globosa or angularis and textura prismatica between locules; the outermost layers composed of black to dark brown cells and the cells of the inner layers brown to hyaline. Asci oblong or clavate, 8 spored, stalked, arising from compressed hyaline tissue at the base of the locule. Ascospores biseriate overlapping in the ascus, hyaline or yellowish, elliptic or obovoid, septate near the middle, not or slightly constricted at the septum, straight or often inequilateral, smooth, sometimes guttulate. Interthecial tissue compressed between asci and intact over the asci.

Barr (1972) believes that the genera *Scirrhodothis* Theiss. & H. Sydow, *Scirrhophragma* Theiss. & H. Sydow and *Metameris* Theiss. & H. Sydow, all synonymized under *Scirrhia* by Müller & von Arx (1962), are different from *Scirrhia* and are pleosporaceous.

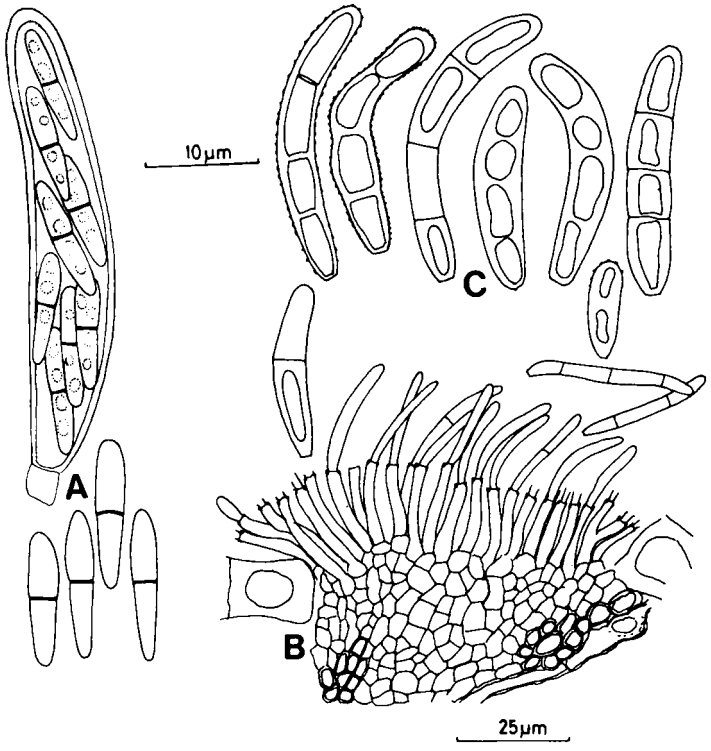


Fig. 150. *Scirrhia acicola*. A, ascus and ascospores; B, v.s. acervulus; C, conidia.

S. acicola (Dearn.) Siggers, *Phytopathology* **29:** 1076, 1939 (Fig. 150).

Oligostroma acicola Dearn., *Mycologia* **18:** 251, 1926.
Systremma acicola (Dearn.) Wolf & Barbour, *Phytopathology* **31:** 70, 1941.
Mycosphaerella dearnessii Barr, *Contr. Univ. Michigan Herb.* **9:** 587, 1972.

Anamorph: *Lecanosticta acicola* (Thüm.) H. Sydow in H. Sydow & Petrak, *Annls mycol.* **22:** 400, 1924.

Cryptosporium acicola Thüm., *Flora:* 178, 1878.
Septoria acicola (Thüm.) Sacc., *Syll. Fung.* **3:** 507, 1884.
Lecanosticta pini H. Sydow in H. Sydow & Petrak, *Annls mycol.* **20:** 211, 1922.
Dothistroma acicola (Thüm.) Schischkina & Tzanava, *Nov. Sist. niz. Rast.* **1967:** 277, 1967.

Ascocarps multiloculate, elliptic, up to 2.5 mm long and 300 µm wide. Locules often in a single row. Asci 30-42 × 6-9 µm. Ascospores hyaline, fusoid, straight to inequilateral, 9-16 × 2.5-4 µm.

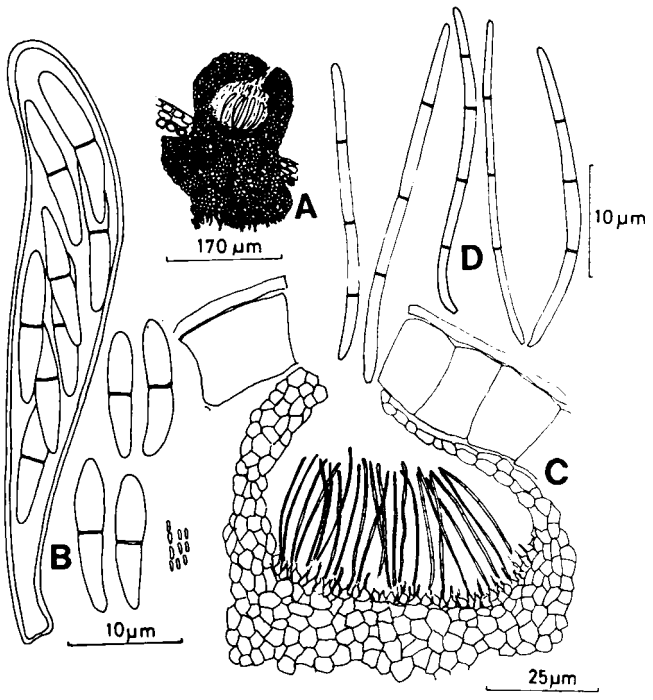


Fig. 151. *Scirrhia pini.* A, v.s. ascocarp; B, ascus and ascospores; C, v.s. pycnidium; D, conidia.

Acervulus in brown spots, subepidermal, erumpent, stromatic with dark brown basal stroma. Conidiophores hyaline to pale brown, simple or branched, septate, smooth, formed from the upper cells of the pseudoparenchyma. Conidiogenous cells holoblastic, integrated or discrete, smooth, cylindrical, hyaline with 1-2 percurrent proliferations. Conidia acrogenous, pale brown to dark brown, straight or curved, mostly 1-3 septate, verrucose, 15-35 × 3-4 µm, with a truncate base and rounded apex.

Microconidia are often found in immature stromata and they are hyaline, one celled, 2-3 × 1 µm.

On needles of *Pinus* spp. Greece, Canada, S. America, U.S.A, USSR, Yugoslavia. This species causes the brown spot needle blight of pine. Punithalingam & Gibson (1973) have fully described and illustrated this species.

S. pini Funk & Parker, *Can. J. Bot.* **44:** 1171, 1966 (Fig. 151).

Anamorph: *Dothistroma septospora* (Dorog.) Morelet var. *septospora, Bull. Soc. Sci. nat. Archéol. Toulon Var* **177:** 9, 1968.

Cytosporina septospora Dorog., *Bull. Soc. Mycol. Fr.* **27:** 106, 1911.
Septoriella septospora (Dorog.) Sacc. in Trotter, *Syll. Fung.* **25:** 480, 1931.
Dothistroma pini Hulbary, *Bull. Ill. nat. Hist. Surv.* **21:** 235, 1941.

Ascocarp multilocular, erumpent, up to 600 μm broad. Asci 35-50 × 7-10 μm. Ascospores fusoid, hyaline, guttulate, slightly constricted at the septum, 11-16 × 3-4 μm, with rounded ends.

Pycnidial stroma subepidermal, erumpent, up to 1.5 mm, on a basal stroma, sometimes divided. Conidiogenous cells holoblastic, hyaline, non proliferating, discrete, determinate, formed from the cells lining the inside of the pycnidial cavity. Conidia hyaline, smooth, straight, or slightly curved, 1-5 (usually 3) septate, 25-60 × 2-3 μm. Spermatia hyaline, rod-shaped, 1-2 × 0.5 μm.

This fungus causes the needle blight and necrosis *(Dothistroma* blight, red band) of pine. Worldwide. It has been fully described and illustrated by Punithalingam & Gibson (1973) with notes on symptoms and pathogenicity.

SPHAERULINA Sacc., *Michelia* **1:** 399, 1878.

Micronectriella Höhnel, *Sber. Akad. Wiss. Wien* **115:** 1194, 1906.
Ophiocarpella Theiss. & H. Sydow, *Annls mycol.* **13:** 644, 1915.

Lectotype sp.: *S. myriadea* (DC.) Sacc., *Michelia* **1:** 399, 1878.

Anamorphs: *Septoria* Sacc. (as *Cylindrosporium* Grev.), *Cercospora* Fres. and *Cercosporella* Sacc.

Pseudothecia scattered, grouped, or closely connected by hyphae, uniloculate, sometimes multiloculate, globose or conical, immersed or erumpent, with an apical ostiole. The wall is composed of thin to fairly thick-walled, brown, polygonal to angular cells. Asci clavate, cylindric-clavate to oblong, fasciculate, stalked or sessile, 8 spored. Ascospores hyaline to very pale brown after discharge, guttulate, overlapping in 1-3 series, cylindric filiform, straight or curved, transversely multiseptate, not or slightly constricted at some septa, smooth, thin-walled, with obtuse ends.

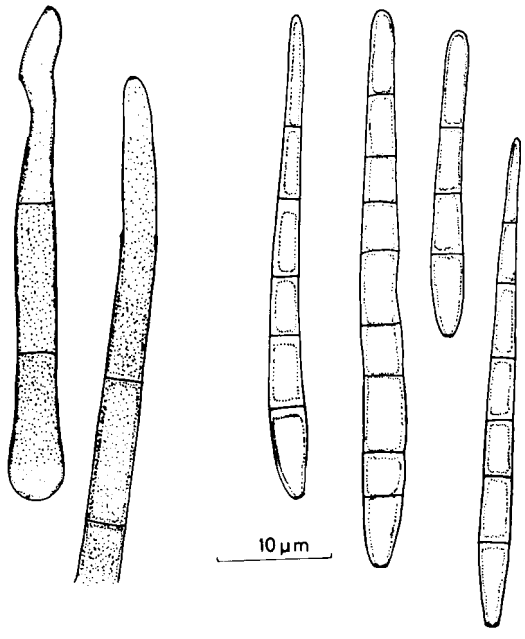


Fig. 152. *Sphaerulina oryzina*. Conidiophores and conidia.

Key to Sphaerulina species with anamorphs

Ascospores 3 septate, anamorph *Cercospora*..... *S. oryzina*

Ascospores 3 (-7) septate, anamorph *Septoria*..... *S. rubi*

Ascospores 2-5 septate, anamorph *Septoria*..... *S. rehmiana*

S. oryzina Hara, *Diseases of the rice Plant:* 144, 1918 (Fig. 152).

Anamorph: *Cercospora oryzae* Miyake, *J. Coll. Agric. Imp. Univ. Tokyo* **2:** 263, 1910.

Pseudothecia scattered or gregarious, immersed, 60-100 µm broad. Asci cylindric-clavate 50-60 × 10-13 µm. Ascospores fusoid, 3 septate, 20-33 × 4-5 µm.

Leaf spots elliptic, oval or linear, pale to dark brown, amphigenous. Conidiophores fasciculate, septate, smooth, simple, slightly geniculate, up to 140 µm long, 4-6 µm thick with an apical scar. Conidia cylindrical, cylindric-obclavate, straight to slightly curved, up to 10 septate, hyaline, 15-60 × 3-6 µm.

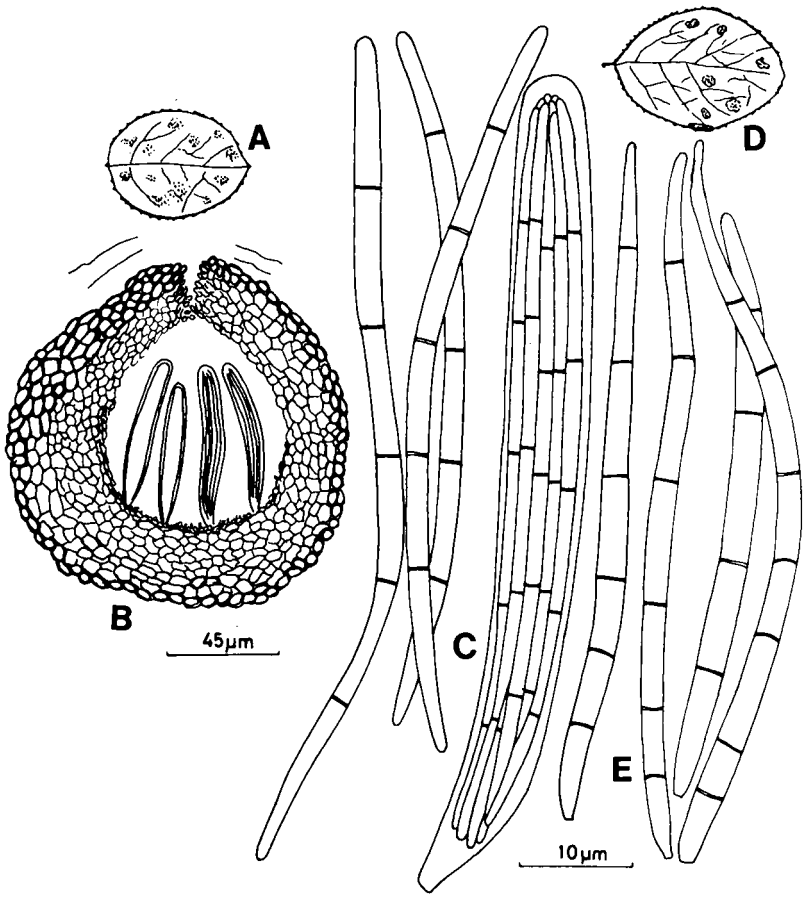


Fig. 153. *Sphaerulina rehmiana* (type). A, pseudothecia on leaves (habit); B, v.s. pseudothecium; C, ascus and ascospores; D, pycnidia on leaves (habit); E, conidia.

On *Oryza sativa*. Japan.

Yoshida (1948) used cultures obtained from the ascospores to inoculate rice leaves and produced spots similar in appearance to those produced by *C. oryzae*. Deighton (1967a) has translated the Japanese paper of Yoshida (1948) into English.

S. rehmiana Jaap, *Abh. Bot. Verh. Prov. Brandenb.* **52:** extra 10, 1910 (Fig. 153).

Anamorph: *Septoria rosae* Desm., *Pl. Crypt. France Ed.* 2, *sér.* 1, fasc. **14**, no. 535, 1831.
See Boerema (1963) for synonyms.

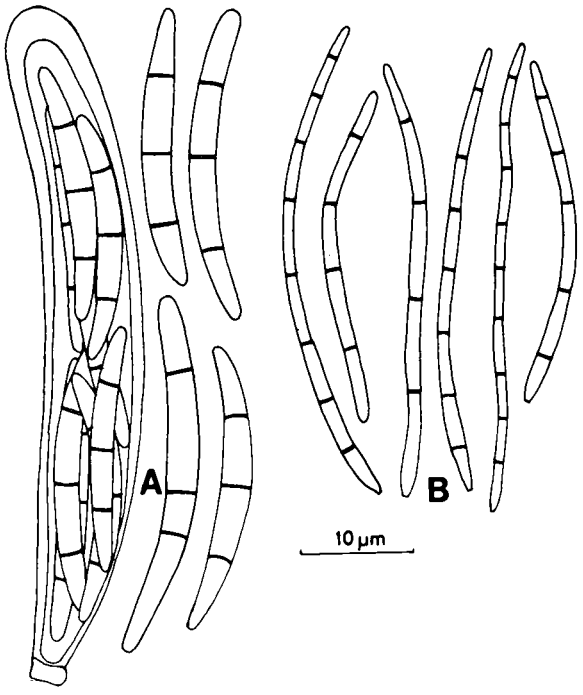


Fig. 154. *Sphaerulina rubi* (type). A, ascus and ascospores; B, conidia.

Pseudothecia amphigenous, up to 150 µm broad. Asci 50-80 × 6-7 µm. Ascospores fusiform, 2-5 septate, 30-80 × 2.5-3.5 µm.

Conidia 3-5 septate, 40-75 × 2-3 µm. Spermatia rod-shaped, hyaline, one celled, 2.5-3 × 0.5 µm (Klebahn, 1918).

On *Rosa* spp. Europe. Boerema (1963) has given a full description of this species with notes on symptoms and isolation. Causes leaf scorch and surface canker (die-back) of rose.

S. rubi Demaree & Wilcox, *Phytopathology* **33:** 997, 1943 (Fig. 154).

Anamorph: *Cylindrosporium rubi* Ell. & Morgan, *J. Mycol.* **1:** 127, 1885.

Pseudothecia scattered, singly or in groups forming blackened areas on both sides of the leaf, often connected in a thin stromata by brown hyphae. Asci 45-70 × 8-15 µm. Ascospores 3(-7) septate, 23-30(57) × 2.5-3.5(5) µm.

Pycnidia developing in brown spots with red margin, on living leaves, up to 125 µm broad, amphigenous, immersed. The wall is composed of

thin-walled brown, angular cells. Conidiogenous cells holoblastic, ampulliform to doliiform, smooth, 5 × 7.5 μm. Conidia hyaline, 3-9 septate, cylindrical, usually curved, thin-walled, 32-86 × 2.5 μm with obtuse ends.

Spermogonia similar to pycnidia, smaller, up to 60 μm broad, hypophyllous with hyaline, rod-shaped spermatia, 1-15 × 1 μm.

On leaves of *Rubus,* Europe, N. America.

Although the pycnidial state was described as a *Cylindrosporium*, it belongs to *Septoria.*

Another species, *S. juglandis* Ito & Kobayashi (1957) was described on living leaves of *Juglans* spp., from Japan with *Cercosporella juglandis* Ito & Kobayashi as the anamorph. It has pseudothecia up to 100 μm broad with asci measuring 43-56 × 8-9 μm. Ascospores cylindric-fusoid, 3-7 septate, hyaline, slightly curved, 24-35 × 3-4 μm. *Cercosporella* conidiophores erect, simple, hyaline, 21-32 × 2-3.5 μm. Conidia curved to flexuous, obclavate, hyaline, 1-10 septate, guttulate, 32-68 × 3-5 μm.

SYDOWIA Bres., *Hedwigia Beibl.* **34:** 66, 1895.

Plowrightia subgenus *Plowrightiella* Sacc., *Syll. Fung.* **11:** 376, 1895.
Pleodothis Clem., *The Gen. of Fungi*: 49, 173, 1909.
Jaapia Kirschst., *Kryptogamenfl. M. Brandenb.* **7:** 444, 1938, non Bres., 1911.
Plowrightiella (Sacc.) Trotter, *Syll. Fung.* **24:** 543, 1926.

Type sp.: *S. polyspora* (Bref. & v. Tavel) E. Müller, *Sydowia* **7:** 342, 1953.

Anamorphs: *Dothichiza* Lib. and *Sclerophoma* Höhnel; *Hormonema*-like state also produced in culture.
Mycelium immersed, branched, septate, pale to dark brown.

Ascostroma depressed globose to conate, immersed at first, later erumpent, uniloculate, with a papillate to rounded short ostiole. The wall, several layers thick, is composed of dark brown cells of textura angularis or sometimes prismatica, more darkened on the outside, hyaline to subhyaline towards the interior. Asci clavate to oblong, many spored, fasciculate or arising in a single layer. Ascospores crowded to overlapping polystichous in the ascus, elliptic, obovate, hyaline, becoming brown, smooth, transversely multiseptate, constricted at the primary septum, sometimes with a vertical septum in the mid cells or rarely in the end cells, straight to inequilateral, guttulate, upper part usually wider and shorter than the lower part.

Pycnidia stromatic, immersed at first, later erumpent, globose to irregular, solitary or aggregated, uni- or multi-locular or convoluted. The wall is thick and dehisces by breaking down the overlying wall tissue. Conidiogenous cells phialidic, enteroblastic, determinate, discrete, hyaline to pale brown, doliiform to ampulliform, with a wide channel and minute collarette, formed from the inner cells of the wall lining the locule. Conidia hyaline, ellipsoid, smooth, one celled, sometimes guttulate, and rarely tapered at the base.

Key to species of Sydowia with anamorphs

Ascocarps on a mycelial subiculum..... *S. dothideoides*

Ascocarps not on a mycelial subiculum..... *S. polyspora*

S. polyspora (Bref. & v. Tavel) E. Müller, *Sydowia* **7:** 342, 1953 (Fig. 155).

Dothidea polyspora Bref. & v. Tavel, *Untersuch. Gesamtgeb. Mykol.* **10:** 296, 1891.
Plowrightia polyspora (Bref. & v. Tavel) Sacc., *Syll. Fung.* **11:** 376, 1895.
Sydowia gregaria Bres., *Hedwigia Beibl.* **34:** 66, 1895.
Pleodothis polyspora (Bref. & v. Tavel) Clem., *The Gen. of Fungi:* 49, 173, 1909.
Hariotia polyspora (Bref. & v. Tavel) Höhnel, *Annls mycol.* **16:** 168, 1918.
Dothiora pinacea Vel., *Monogr. Discomyc. Bohem.:* 47, 1934.

Anamorph: *Sclerophoma pythiophila* (Corda) Höhnel, *Sber. Akad. Wiss. Wien* **118:** 1234, 1909.

Sphaeronema pythiophilum Corda, *Icon. Fung.* **4:** 40, 1840.
Dothichiza pythiophila (Corda) Petrak, *Annls mycol.* **21:** 267, 1923.

Ascocarps depressed globose, scattered or grouped, sometimes confluent, up to 350 μm broad. Asci 70-85 × 12-15 μm 24-32 spored. Ascospores broadest above and narrowed to a pointed base, 1-6, mostly 3 septate, sometimes with a vertical septum in 1-3 cells, 9-28 × 3-8.5 μm.

Conidiogenous cells 4-7 × 4-5 μm. Conidia 4-8 × 2-3 μm.

Saprophytic or parasitic on branches and leaves of various Gymnosperms. Europe, N. America. Sutton & Waterston (1970b) have fully described and illustrated the anamorph. Butin (1963) and Smerlis (1970 a) have established the connection between the ascigerous and pycnidial state as well as their pathogenicity to a number of Gymnosperms.

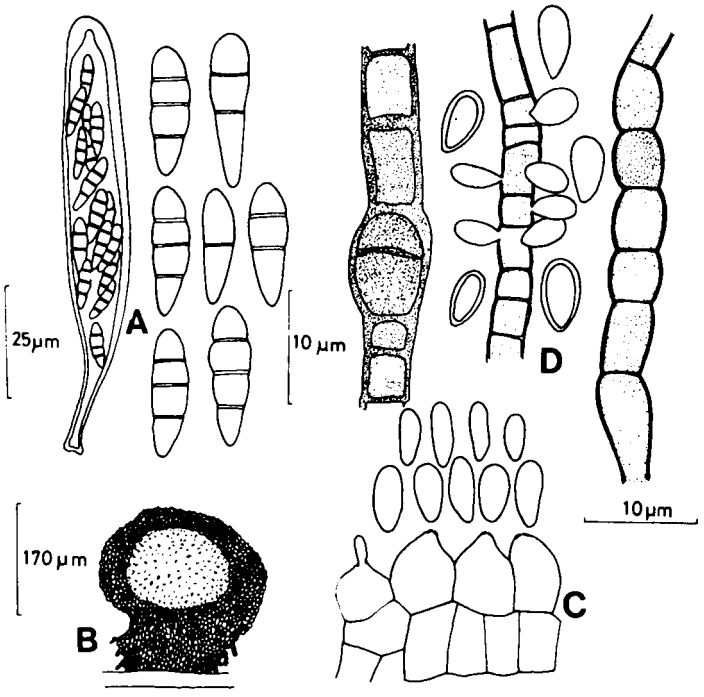


Fig. 155. *Sydowia polyspora.* A, ascus and ascospores; B, v.s. pycnidium; C, conidiogenous cells and conidia; D, *Hormonema* state.

Aureobasidium pullulans (De Bary) Arn. has been connected with *S. pithyophila* by several workers and this connection has been disproved by Xenopoulos & Miller (1977) who consider them to be genetically different.

S. dothideoides Dearn. & Barth., *Mycologia* **18:** 248, 1926.

Dothiora polyspora Shear & Davidson, *Mycologia* **32:** 105, 1940.

Ascocarps on a mycelial subiculum, pulvinate to rounded, up to 725 µm broad, with a somewhat depressed plane apex, uni to bilocular. Asci 90-120 × 18-20 µm, 24-32 spored. Ascospores 13-24 × 4-8 µm, obovate, mostly 3 septate, sometimes up to 6 septate, with a vertical septum in one or more of the mid cells, rarely in one end cell.

Pycnidia of *Dothichiza* type. Conidia 6.5-13 × 3-4 µm, oblong.

The copious subiculum below thickly grouped ascocarps characterizes this species.

On branches and twigs of *Populus tremuloides, Salix* spp. U.S.A.



Hysteriales

Pseudothecia black hysterothecioid (boat shaped to linear, shell-like or wedge-shaped) or irregularly rounded or stellate, opening by longitudinal slit, or orbicular, crustose to typically apothecioid and opening by widely splitting or crumbling. Asci interspersed with pseudoparaphyses. Saprophytes on branches and wood or lichenized.

Hysteriaceae Dumort. ex Corda

Pseudothecia hysterothecioid opening by longitudinal slit, more or less superficial, non-lichenized, on wood and bark.

Hysteriaceae comprise a fairly homogeneous group easily recognised by elongated fruit bodies.

Numerous cultural studies reported (Lohman, 1933, a,b, 1934, a,b; Bisby & Hughes, 1952; Hilitzer, 1929) show some similarity in the anamorphs which are sometimes pycnidial or Hyphomycetous. Hyphomycete anamorphs known include *Acrogenospora* M. B. Ellis, *Coniosporium* Link: Fr., *Papulospora* Preuss (Lohman, 1933a), *Septonema* Corda and *Sporidesmium* Link: Fr. The pycnidial anamorphs have been described under different names viz. *Aposphaeria* Sacc., *Chaetophoma* Cooke, *Dendrophoma* Sacc., *Dothiopsis* P. Karsten, *Plenodomus* Preuss, *Phomopsis* (Sacc.) Sacc., *Phragmotrichum* Kunze and *Sphaeronema* Fr. (Bisby, 1941; Hilitzer, 1929, Lohman, 1933a). Apart from these earlier works no confirmatory studies to prove their genetic connection have been done. In light of the modern concepts adopted on the taxonomy of the Coelomycetes, a detailed study is required not only to confirm the correlations but also to find accurate names for the pycnidial anamorphs.

Only genera with hyphomycete anamorphs are dealt with here.

Hysteriales has been fully monographed by Zogg (1962). British Hysteriales has been studied by Bisby (1941), Bisby & Dennis (1952), Bisby & Hughes (1952). Type studies on certain species have been made by Bisby (1932) and Lohman (1939).

Key to genera of Hysteriaceae with anamorphs

Ascospores brown, non-septate, or with a hyaline basal cell which may be minute ..... *Farlowiella*

Ascospores with several transverse septa ..... *Hysterium*

FARLOWIELLA Sacc., *Syll. Fung.* **9:** 1100, 1891.

Farlowia Sacc., *Syll. Fung.* **2:** 727, 1883, non Agardh., 1876.

Type sp.: *F. carmichaelina* (Berk.) Sacc., *Syll. Fung. 9:* 1101, 1891.

Anamorph: *Acrogenospora* M.B. Ellis (1976).

Hysterothecia long and narrow with pointed ends, smooth, black, opening by a longitudinal slit. Asci 8 spored, cylindric-clavate, short-stalked. Ascospores overlapping uniseriate in the ascus, ovoid, brown, non-septate or with a basal hyaline end cell, which may be minute.

Acrogenospora colonies effuse, dark blackish brown to black, hairy. Conidiophores erect, simple, straight or slightly flexuous, subulate or cylindrical, dark brown at the base, paler towards the apex, smooth. Conidiogenous cells monoblastic, percurrent, terminal, cylindrical, integrated. Conidia solitary, dry, acrogenous, simple, spherical, subspherical, obovoid or ellipsoidal, truncate at the base, mid to dark brown by transmitted light, black and shining by reflected light, smooth, 0-1 septate.

Only two species known and both have an *Acrogenospora* anamorph.

Key to species of Farlowiella

Ascospores 18-27 × 7-12 μm, conidia 20-40 × 15-25 μm..... *F. carmichaelina*

Ascospores 13-15 × 6-7.5 μm, conidia 40-60 × 30-36 μm..... *F. australis.*

F. australis Dennis, *Results of the Norwegian Sci. Exp. to Tristan Da Cunha 1937-1938,* **36:** 10, 1955 (Figs. 156).

Anamorph: *Acrogenospora* sp. (M.B. Ellis, 1976).

Hysterothecia sparse, pulvinate, 300-500 × 190-210 μm. Asci 90 × 12-13 μm. Ascospores continuous, 13-15 × 6-7.5 μm with a hyaline basal protuberance not more than 1 μm long.

Conidiophores up to 800 μm long, 12-20 μm thick. Conidiogenous cells

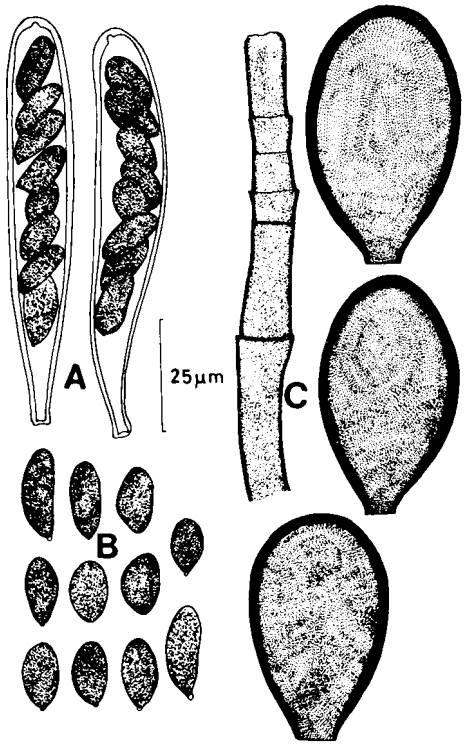


Fig. 156. *Farlowiella australis* (type). A, asci; B, ascospores; C, conidiophore and conidia.

with 0-3 annellations. Conidia broadly ellipsoidal, 40-60 × 30-36 µm thick at the broadest part, 8-10 µm wide at the truncate base.

On branches of *Phylica arborea*. Tristan da Cunha.

F. carmichaelina (Berk.) Sacc., *Syll. Fung.* **9:** 1101, 1891 (Fig. 157).

Hysterium carmichaelianum Berk. in Hooker, *English Flora* **5:** 294, 1836.
Hysterium repandum Blox. in Duby, *Mém. Soc. Phys. D'Hist. Nat. Genèva* **16:** 39, 1862.
Farlowia repanda (Blox.) Sacc., *Syll. Fung.* **2:** 727, 1883.

Anamorph: *Acrogenospora* sp. This anamorph was originally described as *Monotospora megalospora* Berk. & Br. By cultural studies Mason (1941) has showed the genetic connection between this anamorph and *F. carmichaelina*.

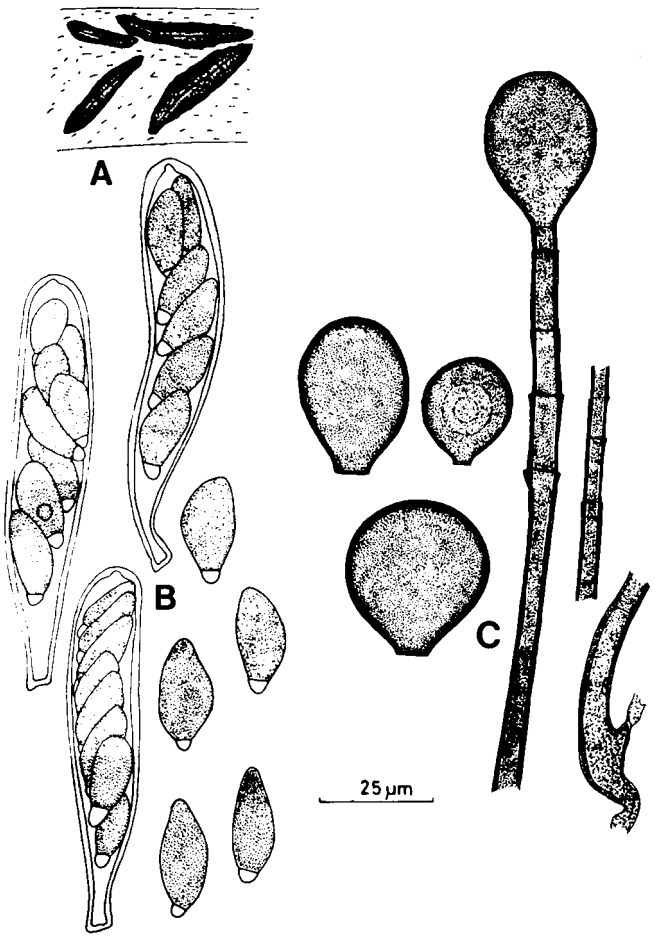


Fig. 157. *Farlowiella carmichaelina*. A, hysterothecia; B, asci and ascospores; C, conidiophores and conidia.

Hysterothecia up to 3 mm long and 0.25 µm broad. Asci 60-90 × 12-18 µm. Ascospores 18-27 × 7-12 µm, brown with a narrow basal hyaline end cell.

Conidiophores up to 400 µm long, 9-12 µm thick. Conidia broadly ellipsoidal to ovoid, brown to dark brown, 20-40 × 15-25 µm.

On rotten wood. Europe, New Zealand.

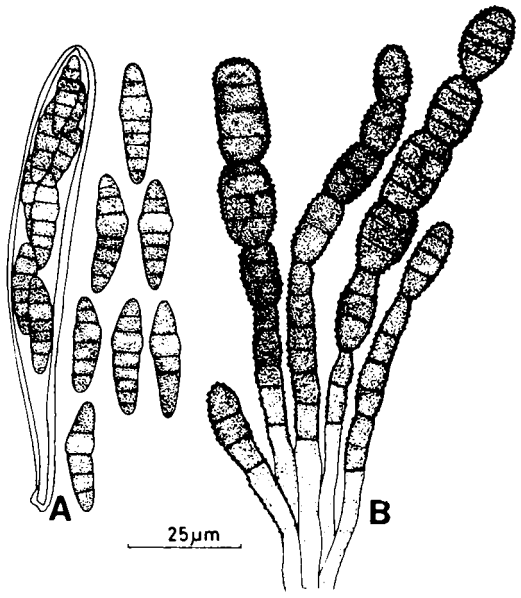


Fig. 158. *Hysterium insidens.* A, ascus and ascospores; B, conidiophores and conidia.

HYSTERIUM Pers.: Fr., *Syst. mycol* **2:** 579, 1923.

H. insidens Schwein., *Trans. Amer. Phil. Soc.* **2,** 4: 244, 1832 (Fig. 158).

Hysterographium insidens (Schwein.) Sacc., *Syll. Fung.* 2: 778, 1883.

(For other synonyms see Zogg, 1962).

Anamorph: *Coniosporium* sp. (for synonymy see Hughes, *Can. J. Bot.* **36:** 754, 1958).

Hysterothecia solitary or in small groups, superficial, up to 2.5 mm long. Asci 100-120 × 10-18 μm. Ascospores 4-9 septate, 20-38 × 6-12 μm, brown.

Sporodochia pulvinate, partially immersed, black, up to 1.5 mm diam. Stroma erumpent, conspicuous. Conidiophores arising from the surface of the stroma bearing chains of conidia, simple or rarely branched, up to 50 μm long, 2-5 μm thick, septate, pale to dark brown, thick-walled, smooth to verruculose. Conidiogenous cells integrated, terminal,

meristematic, more or less cylindrical, fragmenting. Conidia thick-walled, verruculose, 3-9 septate with one or more vertical septa in some conidia, constricted at the septa, 13-38 × 7-18 μm, in long chains and mature basipetally.

On decorticated wood. Canada, Europe, S. Africa, U.S.A.

Lophiaceae Zogg ex von Arx & Müller

Hysterothecia shell-like or wedge-shaped, taller than broad. Ascospores transversely multiseptate, filiform to elongate fusiform or elliptic-cylindric, hyaline to brown. On wood and bark.

Only one genus with anamorph is treated here.

MYTILINIDION Duby, *Mém. Soc. Phys. Genève* **16:** 34, 1861 (= *Mytilidion).*

Type sp.: *M. mytilinellum* (Fr.) Zogg, *Beitr. Krypt.-Fl. Schweiz* **11**(3): 103, 1962.

Anamorphs: *Septonema* Corda, *Aposphaeria* Sacc., *Pyrenochaeta* de Not., *Sclerochaeta* Höhnel.

Hysterothecia shell-shaped, relatively thick-walled, with a longitudinal slit along the upper edge. Asci narrowly cylindrical, 8 spored. Ascospores transversely multiseptate, elliptic-cylindric, brown.

Septonema Corda: Colonies effuse, hairy or velvety, pale olivaceous to dark brown. Conidiophores simple or with short lateral branches, straight, smooth, brown, sometimes slightly flexuous. Conidiogenous cells monoblastic or sometimes polyblastic, terminal and intercalary on stipe and branches, integrated, determinate, cylindrical. Conidia dry, mostly acrogenous, formed in long, often unbranched, acropetal chains, seceding readily, simple, cylindrical or oblong, abruptly tapered to the usually truncate ends, ellipsoidal or fusiform, pale to dark brown or reddish brown, smooth to coarsely roughened, rather thick-walled, with one or several transverse septa.

Species with *Septonema* anamorph are only dealt with here. For descriptions of species with pycnidial anamorphs refer to the publication by Lohman (1933a).

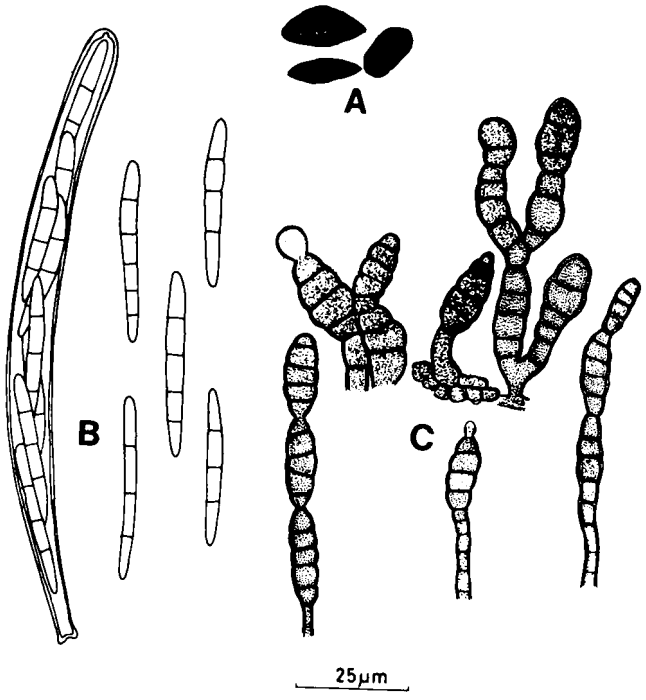


Fig. 159. *Mytilinidion karstenii*. A, hysterothecia (habit sketch); B, ascus and ascospores; C, conidiophores and conidia.

Key to Mytilinidion species with Septonema anamorph

Ascospores 3-5 septate, 24-50 × 3-5 μm..... *M. karstenii*

Ascospores 5-7 septate, 40-50 × 2-2.5 μm..... *M. scolecosporum*

M. karstenii Sacc., *Syll. Fung.* **2:** 763, 1883 (Fig. 159).

Anamorph: *Septonema* sp. (Lohman, 1933b).

Hysterothecia erect up to 1 mm long. Asci 120-160 × 8-12 μm. Ascospores 3-4(5) septate, brown, slightly or not constricted at the septa, fusoid, 24-50 × 3-5 μm.

Septonema conidial state was obtained from ascospores by Bisby (1941) and Bisby & Hughes (1952). Lohman (1933b) observed the *Septonema* anamorph associated with the type material. Conidia fuscous, 3-5 septate, 15-35 × 6-11 μm, coarsely roughened or smooth.

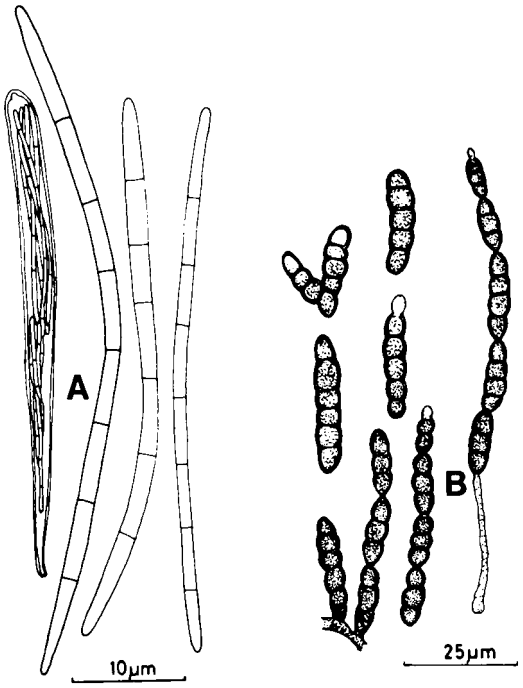


Fig. 160. *Mytilinidion scolecosporum* (type). A, ascus and ascospores; B, conidiophore and conidia.

On bark, wood and needles of *Pinus*. Europe.

M. scolecosporum Lohman, *Mycologia* **24:** 480, 1932 (Fig. 160).

Anamorph: *Septonema toruloideum* Cooke & Ellis, *Grevillea* **7:** 6, 1878.

Hysterothecia up to 0.3 mm long, 0.4 mm high, longitudinally striate, occasionally three radiate or in pairs. Asci 100-130 × 4-5.5 μm. Ascospores subvermiform, occasionally curved or subsigmoid, yellow to brown, 5-7 septate, 40-50 × 2-2.5 μm.

Conidia elliptic-oblong, deep fuscous, 3-5 septate, deeply constricted, tapering towards the apex, with 1-2 paler apical cells, 14-24 × 4-6 μm. The anamorph was obtained in culture from ascospores by Lohman (1933b).

On wood of *Pinus strobus*. U.S.A.

Patellariaceae Corda

Ascomata apothecioid, rounded to pulvinate, sessile or stalked, black, subgelatinous, dehiscing by shedding the overlying apical tissue. Asci thick-walled, 4-8 spored. Ascospores hyaline to brown, one or more septate. Pseudoparaphyses filamentous, septate, branched, forked, swollen at the top, often forming a gelatinous epithecium.

Parasitic on lichens, or saprophytic on wood, twigs and bark.

Key to genera with anamorphs.

Ascospores brown, 1-3 septate, lichen parasites..... *Abrothallus*

Ascospores brown, 1 septate, saprophytes..... *Eutryblidiella*

ABROTHALLUS de Not., *Memorie R. Acad. Sci. Torino, ser.* 2, **10:** 351, 1849.

Type sp.: *A. bertianus* de Not.

A. suecicus (Kirschst.) Nordin, *Svensk. bot. Tidskr.* **58:** 226, 1964.

Leciographa suecica Kirschst., *Annls mycol.* **33:** 203, 1935.

Anamorph: *Vouauxiomyces ramalinae* (Nordin) D. Hawksw., *Bull. Br. Mus. Hist.* (Bot.) **9:** 67, 1981.

Phoma ramalinae Nordin, *Svensk. bot. Tidskr.* **58:** 227, 1964.

Ascocarps scattered or more or less aggregated in the apothecial disc of *Ramalina* species, rarely on the thallus or underside of the apothecium, immersed becoming erumpent and sessile, strongly convex to more or less globose, distinctly constricted at the base, 0.3-0.4 × 0.15-0.25 mm, brown to dark brown. Epithecial layer brown, up to 5 μm thick. Fertile layer up to 75 μm thick. Asci clavate with rounded apex, 8 spored, 40-45 × 12-15 μm. Ascospores 1-3 septate, distinctly constricted at the middle septum, brown when mature, slightly verrucose, 14-20 × 5-7 μm, with acute distal and usually more or less rounded proximal ends. Pseudoparaphyses branched, septate, anastomosing.

Pycnidia immersed becoming erumpent, scattered or aggregated in a ring, black, ostiolate, up to 75 μm broad. Pycnidial wall pseudoparenchymatous, textura angularis. Conidiogenous cells holoblastic, percurrently proliferating, with up to 3 annellations hyaline, ampulliform to

lageniform, smooth, 4-10 × 3-5 μm. Conidia arising singly, hyaline, obpyriform, more or less smooth-walled but perhaps sparsely echinulate, 3-6 × 2-4 μm, guttulate, collecting in a mucilaginous mass in the pycnidial cavity, simple, with a rounded apex and abruptly truncate base.

The connection is based on the repeated occurrence of the ascomata in association with the anamorph.

On *Ramalina* thallus and especially on apothecia. France, Finland, Norway, Sweden, United Kingdom.

EUTRYBLIDIELLA (Rehm) Höhnel, *Sber. Akad. Wiss. Wien* **127:** 564, 1918 emend Petrak 1959.

Type sp.: *E. hysterina* (Duf.) Petrak, *Sydowia* **13:** 242, 1959.

E. sabina (de Not.) Höhnel, *Sber. Akad. Wiss. Wien* 127: 564, 1918 (Fig. 161).

Tryblidium sabinum de Not., *Comm. Soc. Critt. Ital.* **2:** 491, 1867.
Cenangium deformatum Peck, *Bull. N. Y. St. Mus.* **28:** 68, 1876.
Karschia sabinae Rehm, *Hedwigia* **21:** 115, 1882.
Cenangella deformata (Peck) Sacc., *Syll. Fung.* **8:** 593, 1889.
Caldesia sabinae (de Not.) Rehm in Rabenh., *Kryptog.-Fl.* **1:** 290, 1890.
Brunaudia sabinae (de Not.) Kuntze, *Rev. Gen. Pl.* **3:** 447, 1898.
Tryblidiopsis occidentalis Earle in Greene, *Pl. Bakeriana* **2:** 9, 1901.
Phaeangella deformata (Peck) Sacc. & Sacc., *Syll. Fung.* **18:** 128, 1906.
Karschia deformata (Peck) Peck, *Bull. N. Y. St. Mus.* **137:** 117, 1909.
Tryblidiella sabinae (de Not.) Nannf., *Nova Acta Soc. Scient. upsal. Sw.* 4, **8:** 334, 1932.
Dermatella deformata (Peck) Seaver, *The North Am. Cup. Fungi:* 313, 1951.

Ascocarps rounded to angular, single, scattered or gregarious, erumpent or superficial, sessile or stalked, black, hemispherical, becoming disc-shaped with the covering layer dehiscing irregularly to expose the black hymenium, up to 1.5 mm diam. The wall of two layers is composed of an outer pseudoparenchymatous layer and inner plectenchymatous layer. Asci cylindrical to clavate, 8 spored, 100-175 × 24-46 μm. Ascospores broadly ellipsoid, dark brown, septate in the middle, constricted at the septum, thick-walled, 25-40 × 13-20 μm, with two polar germ pores. Pseudoparaphyses filiform, branched, septate, anastomosing above asci with tips somewhat swollen and deliquescing to form a yellowish brown gelatinous epithecium.

According to Groves' unpublished notes, *E. sabina* grows readily on *Juniperus* twigs in culture forming both teleomorph and anamorph.

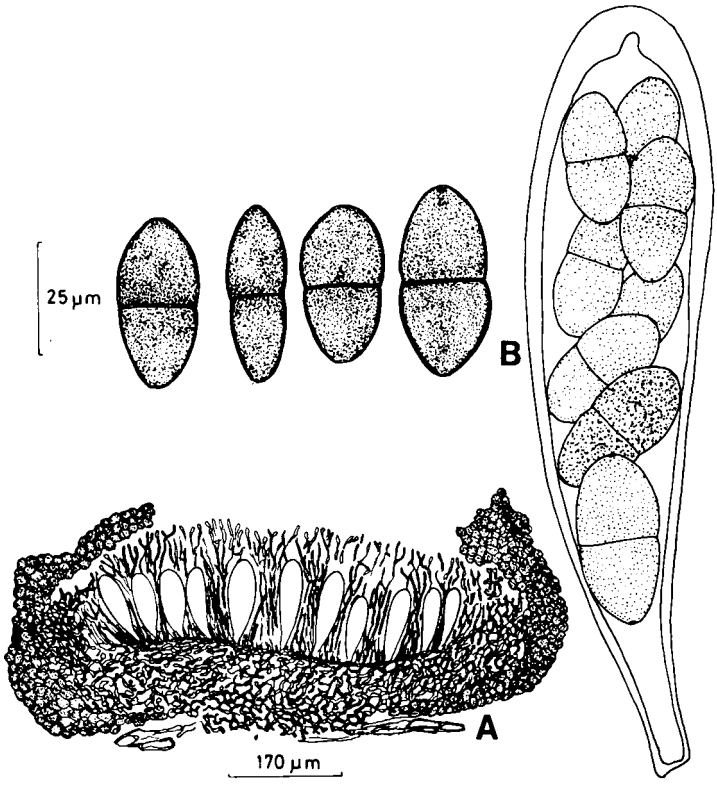


Fig. 161. *Eutryblidiella sabina*. A, v.s. ascocarp; B, ascus and ascospores.

Pycnidia are separate or aggregated, up to 0.1 mm broad. Conidia are one celled, hyaline, ovoid to ellipsoidal, 1.5-3 × 0.8-1.5 µm and are extruded as a pale yellow slimy mass. Von Arx & Müller (1975) report that the anamorph for this genus is *Phoma* or *Diplodia*-like.

Pirozynski & Reid (1966) have fully described and illustrated the teleomorph.

On dead wood, twigs and bark of *Juniperus* spp. Bermuda, Europe, North America, Pakistan.

Microthyriales

Mycelium superficial, forming an open network or bands or plates of radiating or less commonly inconspicuous hyphae, with or without hyphopodia. Ascocarps superficial, rarely subcuticular, dimidiate-scutate opening by a small round ostiole in the centre of the shield or apothecioid and opening by crumbling or fissure to form a broad pore, longitudinal slit or irregular slit, unilocular or multiloculars and may fuse laterally, with radiate or non radiate shield. The internal mycelium may form a hypostroma. Parasites send haustoria into the host epidermal cells, or the mycelium may be partly or entirely internal. Asci variable in shape and in arrangement within the locule. Pseudoparaphyses may be filamentous or persistent strands of centrum tissue or disappear at maturity.

This large order is abundantly represented in the tropics and subtropics, but few are present in temperate regions. Parasites or hyperparasites on other fungi, occurring mostly on living leaves, rarely on stems and fruits.

Not all genera with anamorphs listed in The Whole Fungus Vol. 1 in this order are treated here. Genera of two families, Asterinaceae and Vizellaceae, are considered in this treatment.

Asterinaceae Hansf.

Mycelium superficial, septate, brown, forming an open network, with or without hyphopodia. Thyriothecia superficial, flattened, dimidiate scutate, rounded in section, elongate or linear, with the shield composed of radially arranged cells opening by a fissure or slimy dehiscence. Ascospores two or more septate. Pseudoparaphyses filamentous or strands of centrum tissue or disappearing at maturity.

Anamorphs: *Asterostomella* Speg. (pycnidial), *Clasterosporium* Schwein., *Mitteriella* H. Sydow, *Sarcinella* Sacc., *Sporidesmium* Link ex Fr. *Tripospórium* Corda *Septothyrella* Höhnel (Pycnothyrial state)

Key to Genera of Asterinaceae

Superficial mycelium non hyphopodiate, non setose or setose..... 1

Superficial mycelium hyphopodiate, non setose..... 3

1. Superficial mycelium setose..... *Placosoma*

   Superficial mycelium non setose..... 2

2. Mycelium and thyriothecia bearing numerous 3 septate conidia of a hyphomycete ..... *Eupelte*

Mycelium and thyriothecia lacking conidia of a hyphomycete... *Morenoina*

3. Hyphopodia conidiogenous..... *Maurodothina*

Hyphopodia non conidiogenous..... 4

4. Mycelium entirely superficial..... 5

Mycelium partly innate..... 7

5. Ascospores phragmosporous..... *Batistinula*

Ascospores one septate..... 6

6. Thyriothecia composed of thin walled deliquescent cells..... *Clypeolella*

Thyriothecia composed of thick walled cells opening by radiating fissure, crumbling or disintegrating..... *Asterina*

7. Ascospores phragmosporous..... 8

Ascospores one septate..... *Asterodothis*

8. Ascospores elongate fusoid..... *Uleothyrium*

Ascospores cylindrical, clavate, ellipsoidal to subglobose..... *Yamamotoa*

ASTERINA Lév., *Ann. Sci. Nat. sér 3,* **3:** 59, 1845.

Dimerosporium Fuckel, *Symb. mycol.:* 86, 1870.
Asterella (Sacc.) Speg. ex Sacc., *Syll. Fung.* **9:** 393, 1891 non P. de Beauvois 1805.
Myxasterina Höhnel, *Sber. Akad. Wiss. Wien* **118:** 870, 1909.
Englerulaster Höhnel, *Sber. Akad. Wiss. Wien* **119:** 454, 1910.
Parasterina Theiss. & H. & P. Sydow, *Annls mycol.* **15:** 246, 1917.
Calothyriolum Speg., *Boln Acad. nac. Cien. Côrdoba* **23:** 498, 1919.
Opeasterina Speg., *Boln Acad. nac. Cien. Côrdoba* **23:** 498, 1919.
Englera F. Stev. in Stev. & Ryan, *Illin. Biol. Monogr.* **17:** 45, 1939.

Type sp.: *A. melastomatis* Lév., *Ann. Sci. Nat.* sér. 3, **3:** 59, 1845.

Anamorphs: *Asterostomella* Speg., *Clasterosporium* Schwein.

Parasitic on leaves. Mycelium superficial, hyphopodiate, forming haustoria. Thyriothecium superficial, flattened, dimidiate-scutate, orbicular or rounded, opening by a stellate fissure or crumbling of deliquescent cells at the apex. The scutellum (upper wall) is radiate, sometimes fimbriate and is usually composed of radially arranged thick-walled, dark brown cells. Asci broadly clavate, obovate or globose, arising from a hymenium on a thin basal plate, 8 spored, stalked, somewhat thickened near the apex. Ascospores one septate, dark brown. Pseudoparaphyses filamentous or absent.

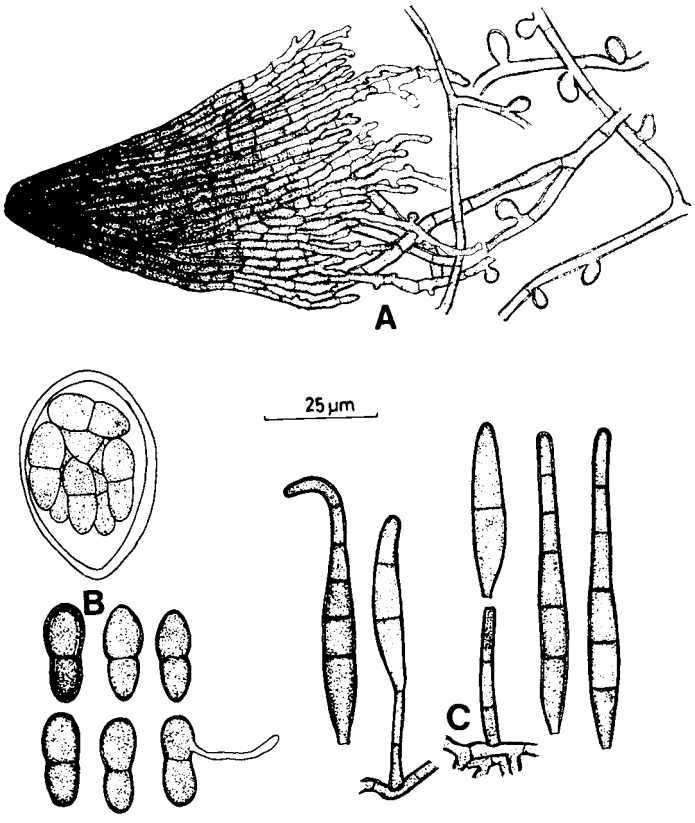


Fig. 162. *Asterina clasterosporium.* A, portion of thyriothecium; B, ascus and ascospores; C, conidiophores and conidia.

The connections are only based on the frequent association of the two states with organic connection, and have yet to be proved by cultural studies.

Numerous species of *Asterina* associated with *Asterostomella* pycnidial states have been described in the literature and it is beyond the scope of this book to include all of them. Only two representative species are described and illustrated here.

A. clasterosporium S. Hughes, *Mycol. Pap.* **50:** 5, 1953 (Fig. 162).

Anamorph: *Clasterosporium* sp.

Colonies hypophyllous, circular, up to 12 μm diam, sometimes confluent, brown to black. Mycelium superficial, hyphopodiate, composed of a repent network of anastomosing, branched, septate, smooth, pale brown, 2-5 μm thick hyphae. Hyphopodia alternate or unilateral, one celled, oblong, rounded at the end, sometimes globose or angular, brown and darker than the hyphae, 6-10 × 4-6 μm. Thyriothecia dispersed to somewhat aggregated, black, convex, orbicular, up to 300 μm in diam. The wall at the base is subhyaline and indistinct. The upper wall (scutellum) with radiate hyphae and fimbriate margin dehisces at maturity by a stellate fissure. Asci numerous, ovoid, among pseudoparaphyses, 8 spored, sessile, 35-55 × 22-25 μm. Ascospores conglobate in the ascus, oblong clavate, ends rounded, dark brown, one septate, constricted at the septum, smooth, 20-23 × 8-10 μm, with sometimes slightly unequal cells.

Conidiophores arise singly on the sides of the hyphae, often from rather dark cells, erect, simple, straight or flexuous, dark brown, 0-2 septate, 20-50 × 4-8 μm. Conidiogenous cells monoblastic, integrated, terminal, determinate, cylindrical. Conidia solitary, straight or slightly flexuous, obclavate, dark brown, paler towards the apex, smooth-walled, 3-5 septate, 45-85 × 7-9 μm thick at the widest part, 4-5 μm thick at the apex, 3-4 μm wide at the truncate base.

On leaves of *Maba warneckei*. Dahomey, Ghana.

A. veronicae (Lib.) Cooke, *Grevillea* **5:** 122, 1877 (Fig. 163).

Dothidea veronicae Lib., *Fl. Crypt. Ard.* **2:** No. 173, 1832.
Sphaeria abjecta Wallr., *Fl. Crypt. Germ.* **2:** 810, 1833.
Dimerosporium abjectum (Wallr.) Fuckel, *Symb. mycol.*: 89, 1870.
Capnodium sphaericum Cooke, *Handb. Brit. Fung.* **2:** 934, 1871.
Meliola abjecta (Wallr.) Schroet. in Rabh., *Hedwigia* **17:** 173, 1878.

Anamorph: *Asterostomella veronicae* (Desm.) Arnaud, *Ann. l'Ecole nat. Agric. Mont.* **16:** 175, 1918.

Asteroma veronicarum Rabenh., *Flora, Jena* **16:** 653, 1858.
Asteroma veronicae Desm., *Pl. Crypt. fasc.* **16:** no. 778, 1836.

Colonies amphigenous, irregular, black spots visible to the naked eye. Mycelium superficial composed of brown, wavy, hyphopodiate hyphae, 3.5-5 μm thick. Hyphopodia unilateral or alternate, one celled, variously lobed, 7-10 × 7-12 μm. Thyriothecia more or less orbicular, sometimes fused together, up to 150 μm diam., opening by a stellate fissure at maturity, scutellum composed of brown, radially arranged quadri-

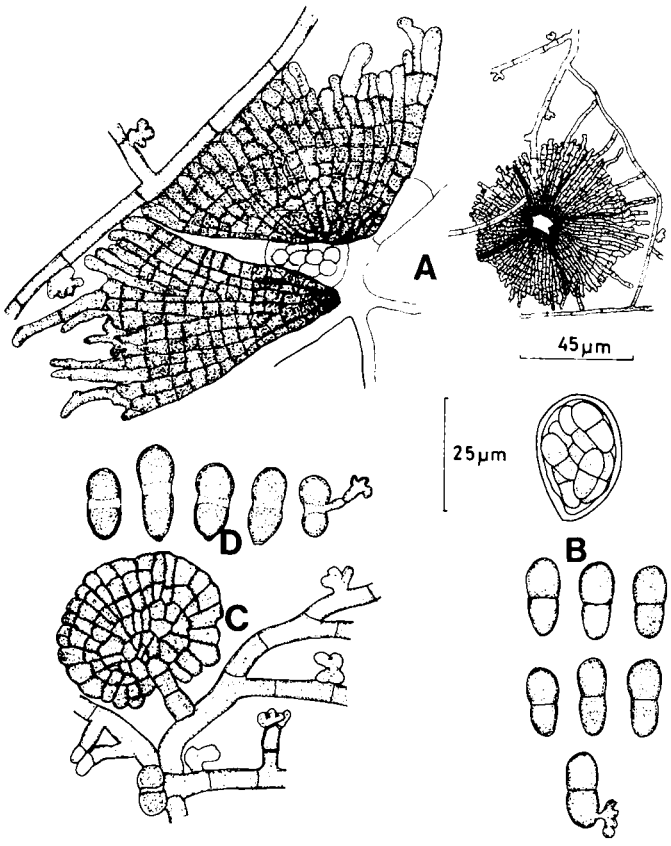


Fig. 163. *Asterina veronicae.* A, thyriothecia; B, ascus and ascospores; C, hyphae bearing pycnidium; D, conidia.

lateral cells 3-5 µm wide, 3-10 µm long, elongated at the rim to form an irregular fringe. Asci subglobose or ellipsoid, 8 spored, 26-38 × 15-24 µm. Ascospores irregularly arranged in the ascus, one septate, brown, smooth, somewhat constricted at the septum, with an upper cell slightly wider than the lower, 14-17 × 6-8 µm.

Pycnidia similar to thyriothecia but smaller and without a fringe, 60-90 µm, in diam. Conidiogenous cells holoblastic, determinate, discrete, doliiform, hyaline, smooth, formed from the inner cells of the wall. Conidia one celled, cylindrical, ends rounded, brown, with a median transverse hyaline band, 14-19 × 5-8 µm.

On leaves of *Veronica officinalis.* Europe.

ASTERODOTHIS Theiss., *Annls mycol.* **10:** 179, 1912.

This genus is monotypic.

A. solaris (Kalchbr. & Cooke) Theiss., *Annls mycol.* 10: 179, 1912 (Fig. 164).

Asterina solaris Kalchbr. & Cooke, *Grevillea* **9:** 33, 1880.

Anamorph: *Clasterosporium* sp.

Colonies amphigenous, mostly hypophyllous, circular, black, up to 6 mm in diam. Superficial mycelium hyphopodiate, composed of radiating and parallel, repent, branched, anastomosing, septate, pale to brown, 3-7 μm thick hyphae. Hyphopodia lateral or terminal, stalked, usually globose, smooth, brown, darker than hyphae and stalk cell, 9-13 μm in diam., with the stalk cell straight of often curved, cylindrical, 10-12 × 6-7 μm.

Stromata pseudoparenchymatic, radiating from a narrow, cylindrical central column, 2-5 mm in diam. Hypostroma is formed between the epidermis and the palisade cells. The hypostroma at certain points becomes much thickened and a hyphal mass is produced above the palisade tissue. From this hyphal mass a short cylindrical column of perpendicular prosenchymatous structure is formed rupturing the epidermis and the hyphae composing it to flatten out horizontally to form the stroma. Certain hyphae form a hypothecium and others grow to a higher level producing the radial covering membrane. The central part of the stroma is sterile with many locules scattered at some distance from it forming a crown around it. The locules are up to 250 μm wide and 100-160 μm high and dehisce irregularly by a stellate or longitudinal fissure. They are connected to the hypostroma by dark peg like hyphae which pierce through the stomata. Numerous dark brown, septate, branched hyphae may radiate from the stroma. Asci ovoid to clavate, 8 spored, 70-90 × 24-28 μm. Ascospores distichous, ellipsoid, smooth, reddish brown, one septate, 27-33 × 8-12 μm. Pseudoparaphyses filiform, hyaline and numerous.

Conidiophores lateral on hyphae, single, erect, simple, straight or flexuous, cylindrical, often slightly constricted at the septa, rounded at the apex, mid to dark brown, 0-4 septate, 18-44 × 6-9 μm, with up to three cylindrical to barrel-shaped proliferations. Conidia formed singly as blown-out ends at the apex of the conidiophore and successive proliferations, straight or slightly curved, more or less cylindrical, 2-4 septate, often slightly constricted at the septa, mid to dark brown, rounded at the apex, 40-65 × 9-13 μm, 6-8 μm thick at the truncate base, with a pale transverse band on the uppermost cell where

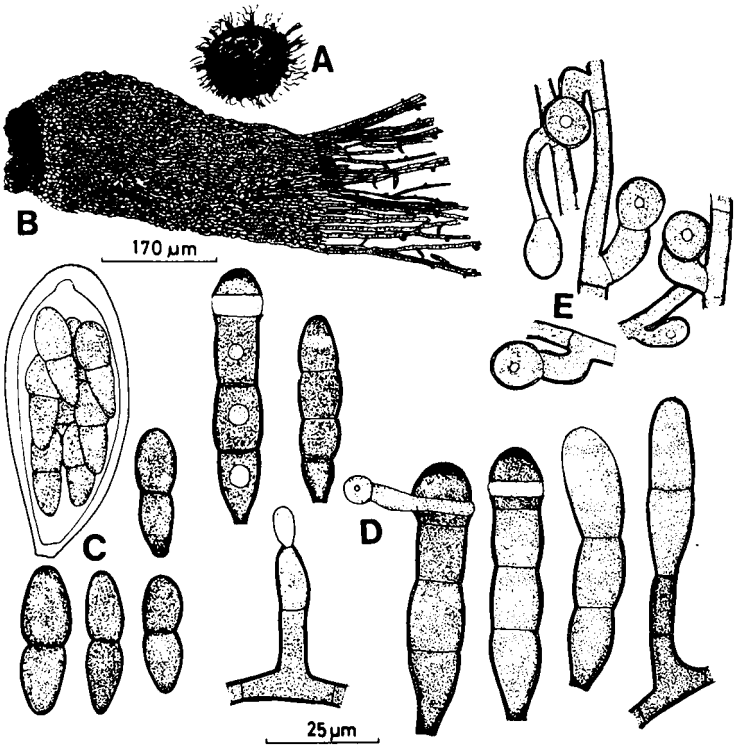


Fig. 164. *Asterodothis solaris.* A, stroma; B, portion of stroma; C, ascus and ascospores; D, conidiophores and conidia; E, mycelium with hyphopodia.

germination occurs after the cell wall splits at this region. The germ tubes form hyphopodia soon after germination.

On *Olea* and *Elaeodendron.* Africa.

Batista & Vital (1957) have described the anamorph as *Asterostromina solaris.*

BATISTINULA von Arx, *Publ. Inst. Micol. Univ. Recife* **287:** 4, 1960.

The genus is monotypic.

B. gallesiae von Arx, *Publ. Inst. Micol. Univ. Racife* **287:** 4, 1960 (Fig. 165).

Anamorph: *Triposporium* sp. (associated)

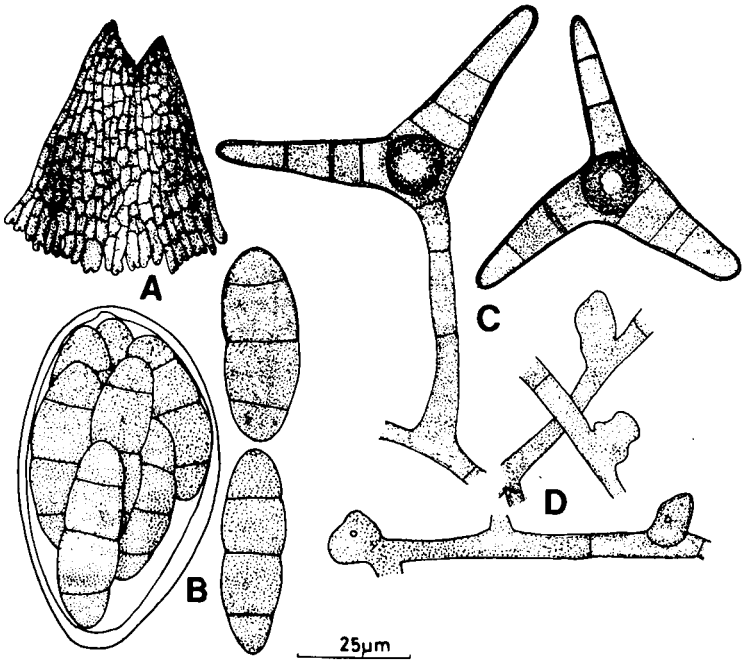


Fig. 165. *Batistinula gallesiae* (type). A, portion of thyriothecium; B, ascus and ascospores; C, conidia; D, mycelium with hyphopodia.

Colonies epiphyllous, not forming spots, orbicular to irregular, sometimes confluent, grey to grey brown or dark brown. Superficial mycelium composed of reticulate, branched, septate, pale brown, hyphopodiate, 5.5-7 µm thick hyphae. Hyphopodia numerous, alternate to unilateral, subglobose to broadly cylindrical, irregularly lobed, continuous, 9-12 µm broad. Pseudothecia scattered or gregarious, dimidiate-scutate, orbicular, black, up to 270 µm broad, opening at maturity by a stellate fissure. The pseudothecial wall (scutellum) 12-20 µm thick is somewhat fimbriate at the margin with radiating, indistinctly septate, opaque dark brown, 2-3 µm thick hyphae and is composed of several layers of pale brown cells, 6-9 µm wide. Asci few, ovoid to broadly clavate, sessile, thick-walled, 4-8 spored, 60-90 × 35-50 µm. Ascospores fusoid, 3 septate with smaller end cells, constricted at the central septum, inequilateral, straight, smooth, brown, with attenuate to broadly rounded ends, 38-52 × 14-18 µm. Pseudoparaphyses mucose.

Conidiophores arising singly from the hyphae, erect, straight or flexuous, cylindrical, simple, septate, brown, 48-60 × 4-7 µm. Conidia formed singly and terminally (blastic) at the apex of the conidiophore,

stauriform with three branches, brown, branches 3-5 septate, 30-40 long and 10-16 μm thick.

The connection is based on the occurrence of pseudothecia and the anamorph on mycelia common to both these fruit bodies and yet to be proved by ascospore cultures.

On leaves of *Gallesia gorazema*. Brazil.

CLYPEOLELLA Höhnel, *Sber. Akad. Wiss. Wien* **119:** 403, 1910.

Type sp.: *C. inversa* Höhnel, *Sber. Akad. Wiss. Wien* **119:** 403, 1910.

Anamorphs: *Mitteriella* H. Sydow and *Sarcinella* Sacc. (Ellis, 1971).

Parasites on leaves and rarely on branches. Mycelium superficial, composed of brown, septate, branched, hyphopodiate hyphae forming haustoria. Thyriothecia superficial, circular or irregular in outline, developing beneath the mycelium, opening by a stellate fissure. The scutellum is composed of thin-walled cells arranged radially and disintegrating into a slime with the outer edge remaining radiate. Asci broadly clavate, globose or obovate, 8 spored. Ascospores one septate, brown.

Mitteriella conidiophores short, simple, brown, smooth or verruculose. Conidiogenous cells polyblastic, integrated, terminal, sympodial, cylindrical or clavate, denticulate. Denticles cylindrical to conical, thin-walled, short or elongated, often collapsing, simple, continuous. Conidia solitary, dry, acropleurogenous, broadly ellipsoid, limoniform, fusoid or falcate, straight to curved, 0-4 septate, smooth or verruculose often with intermediate cells brown to dark brown and end cells pale or hyaline, rarely with cells uniformly pigmented throughout.

Sarcinella conidiophores simple or branched, brown, smooth. Conidiogenous cells monoblastic, integrated, terminal or intercalary, determinate, cylindrical. Conidia solitary, dry, acrogenous, pleurogenous, simple, subspherical or irregularly sarciniform, dark brown or reddish brown, smooth, dictyoseptate, septa sometimes cruciately arranged, deeply constricted at the septa.

Clypeolella is very similar to *Schiffnerula* in the anamorphs. Thyriothecia of *Clypeolella* are more strongly radiate even from the early stages of development and are formed beneath the mycelial hyphae. In *Schiffnerula* the pseudothecia are lateral and develop in the meshes of the mycelium and are erect, more or less globose with a pseudoparenchymatous wall which become mucose diffluent. They are closely related and may be cogeneric.

The *Mitteriella* anamorph with falcate conidia in *Clypeolella* and *Schiffnerula* is best placed in *Questieriella* Arn. which needs to be validated. This will probably lead to the merger of *Schiffnerula* with *Clypeolella* when a better understanding of their close relationships is revealed by further study. Hughes has now validated *Questieriella* in *Can. J. Bot.* **61:** 1727-1767, 1983, and has described and tabulated some *Clypeolella* species with *Sarcinella, Mitteriella* and *Questieriella* synanamorphs.

About twenty five species have been described and their separation is mainly based on host. A revisionary study of the species will eventually result in fewer recognized species. I have, therefore, only included species described with anamorphs and have not attempted to critically revise them or provide a key to them. No work has been done in culture to establish the correlation between the states, but evidence of their connection is circumstantial and they have been frequently observed to occur together.

Clypeolella species with anamorphs

C. anisophylleae H. Sydow, *Annls mycol.* **36:** 190, 1938.

Thyriothecia 100-160 μm broad. Asci 38-70 × 18-22 μm. Ascospores 14-17 × 5-6 μm. Conidia 3 septate, 21-28 × 4-5 μm.

On *Anisophyllea laurina.* Sierra Leone.

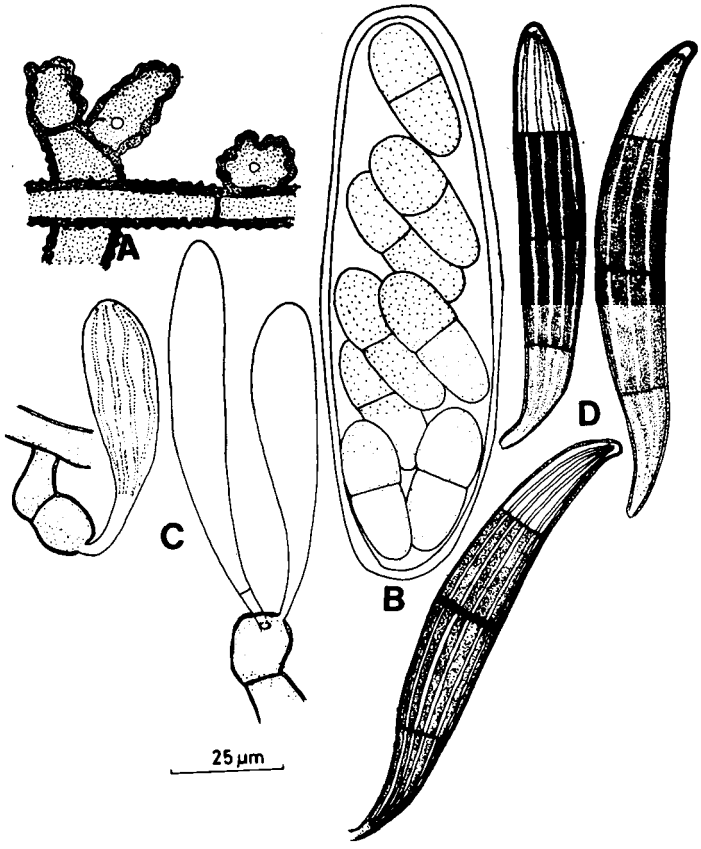


Fig. 166. *Clypeolella camelliae* (type). A, hyphopodia; B, ascus; C, conidiophores and conidium; D, conidia.

C. camelliae (H. & P. Sydow & Butler) Hansf., *Reinwardtia* **3**: 127, 1954 (Fig. 166).

Thyriothecia up to 350 µm broad. Asci 60-70 × 30-40 µm. Ascospores 30-40 × 16-18 µm. Conidia formed singly on short branches of the mycelium, fusoid, 3 septate, smooth, not constricted, subhyaline with darker central cells, attenuate to subtruncate base and more or less elongate-attenuate to subacute, curved apex, 100-125 × 16-19 µm, striate. On *Thea sinensis*. Indonesia, India, Sri Lanka. Mycelium and hyphopodia distinctly crenulate.

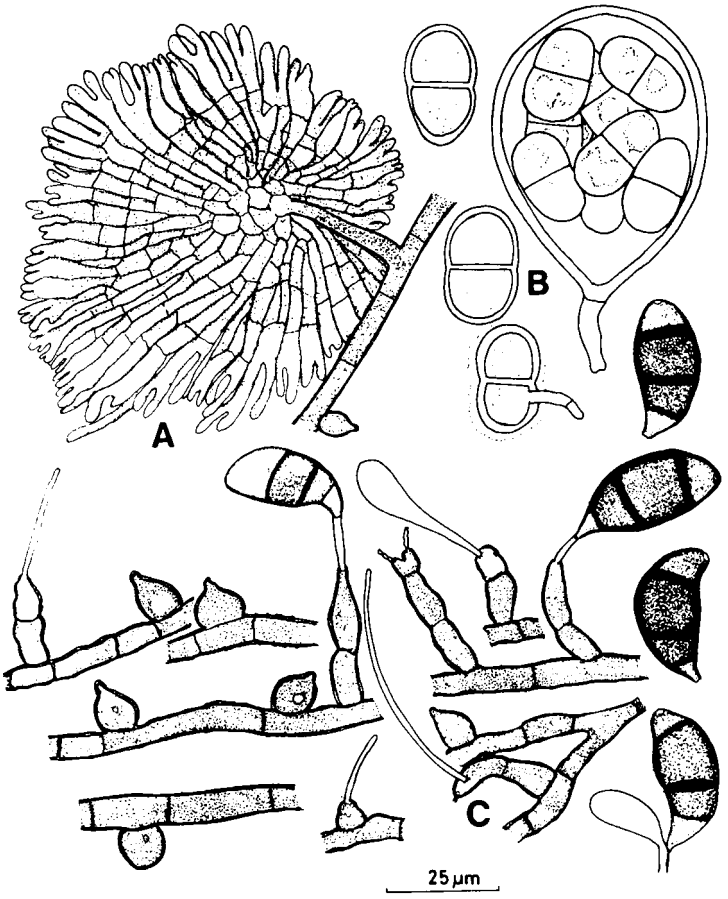


Fig. 167. *Clypeolella craterispermi* (type). A, thyriothecium; B, ascus and ascospores; C, mycelia; conidiophores and conidia.

C. craterispermi Hansf., *Proc. Linn. Soc. Lond.* **157:** 31, 1945 (Fig. 167).

Thyriothecia 200-250 µm broad. Asci 30-40 × 25-30 µm. Ascospores 18-25 × 11-13 µm. Conidia clavate, bent, 27-32 × 14-16 µm (as *'Mitteriella craterispermi'* Hansf.).

On *Craterispermum laurinum*. Uganda.

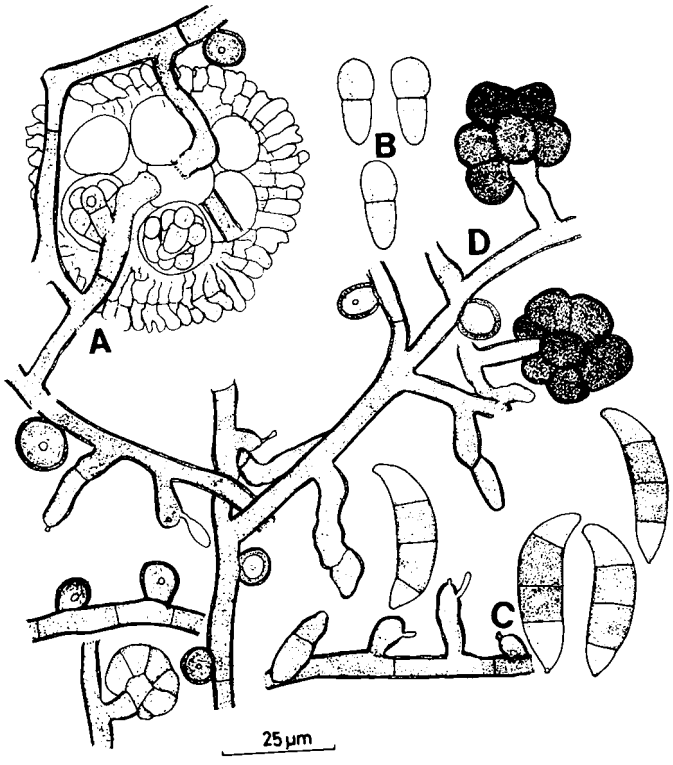


Fig. 168. *Clypeolella gymnosporiae* (type). A, thyriothecium; B, ascospores; C, conidiophores and conidia of *Mitteriella* state; D, mycelia with *Sarcinella* state.

C. crypteroniae Hansf., *Reinwardtia* **3:** 128, 1954.

Thyriothecia immature, asci and ascospores not seen. Conidia 3 septate, 30-38 × 6-7 µm.

On *Crypteronia paniculata*. Indonesia.

C. gymnosporiae Hansf., *Proc. Linn. Soc. Lond.* **157:** 200, 1946 (Fig. 168).

Thyriothecia 80-150 µm broad. Asci 35-40 × 25-35 µm. Ascospores 18-23 × 7-11 µm. Conidia 3 septate, 35-50 × 8-11 µm. *Sarcinella* conidia 20-35 µm broad.

On *Gymnosporia buxifolia*. Uganda.

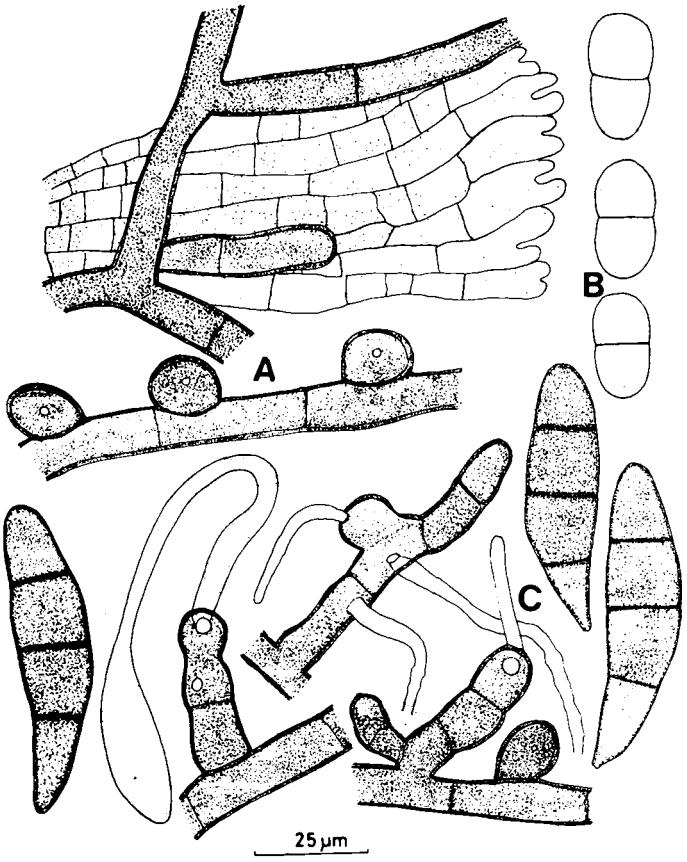


Fig. 169. *Clypeolella hendrickxii.* A, portion of thyriothecium and mycelia; B, ascospores; C, conidiophores and conidia of *Mitteriella* state.

C. hendrickxii Hansf., *Proc. Linn. Soc. Lond.* **158:** 44, 1947 (Fig. 169).

Thyriothecia up to 500 µm broad. Asci 35-50 × 30-50 µm. Ascospores 25-36 × 15-18 µm. Conidia 50-75 × 16-19 µm, 3 septate. *Sarcinella* conidia up to 70 µm broad.

On *Grumilea* spp. Zaire.

C. inversa Höhnel, *Sber. Akad. Wiss. Wien* **119:** 403, 1910 (Fig. 170).

Thyriothecia 160-270 µm broad. Asci 50-65 × 35-45 µm. Ascospores 20-25 × 8-11 µm. *Mitteriella* conidia 3 septate, 28-36 × 10-16 µm with end cells paler than the central cells.

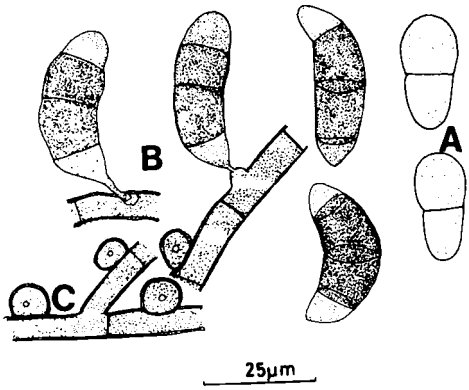


Fig. 170. *Clypeolella inversa* (type). A, ascospores; B, *Mitteriella* state; C, hyphae.

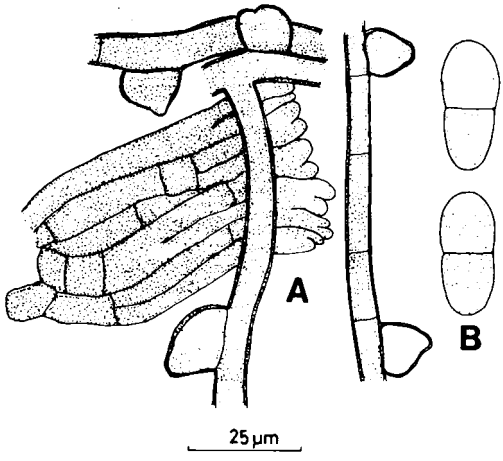


Fig. 171. *Clypeolella psychotriae*. A, portion of thyriothecium and hyphae; B, ascospores.

On *Maytenus* spp. Brazil.

G. psychotriae (Doidge) Doidge, *Bothalia* **4**: 313, 1942 (Fig. 171).

Thyriothecia 320-400 µm broad. Asci 40-53 × 35-40 µm. Ascospores 23-32 × 11-14 µm. Conidia 3 septate, 45-55 × 11-12.5 µm.

On *Psychotria capensis*. S. Africa.

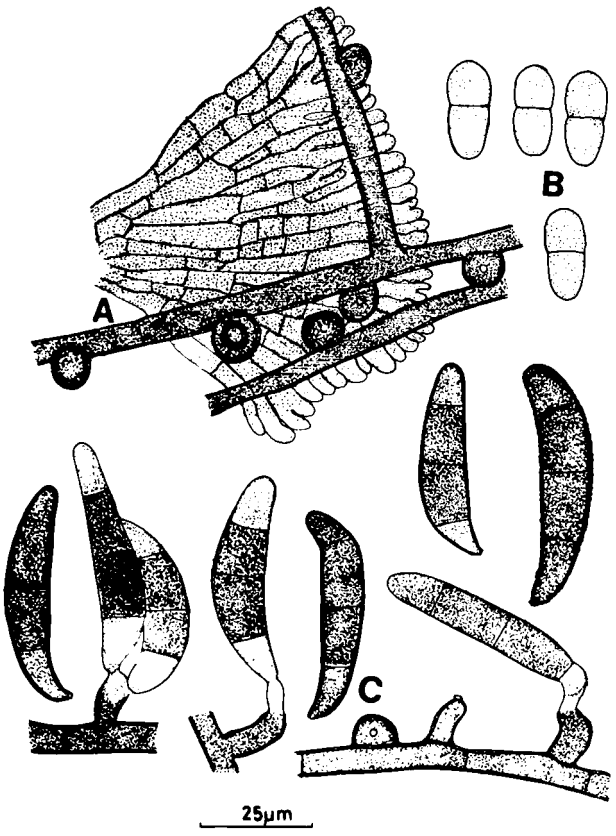


Fig. 172. *Clypeolella rhamnicola* (type). A, portion of thyriothecium; B, ascospores; C, *Mitteriella* state.

C. rhamnicola (Doidge) Doidge, *Bothalia* **4**: 314, 1942 (Fig. 172).

Thyriothecia 225-300 µm broad. Asci 45-55 × 23-38 µm. Ascospores 20-25 × 8-12.5 µm. Conidia 40-57 × 12-15 µm, smooth to verruculose.

On *Rhamnus prinoides*. S. Africa.

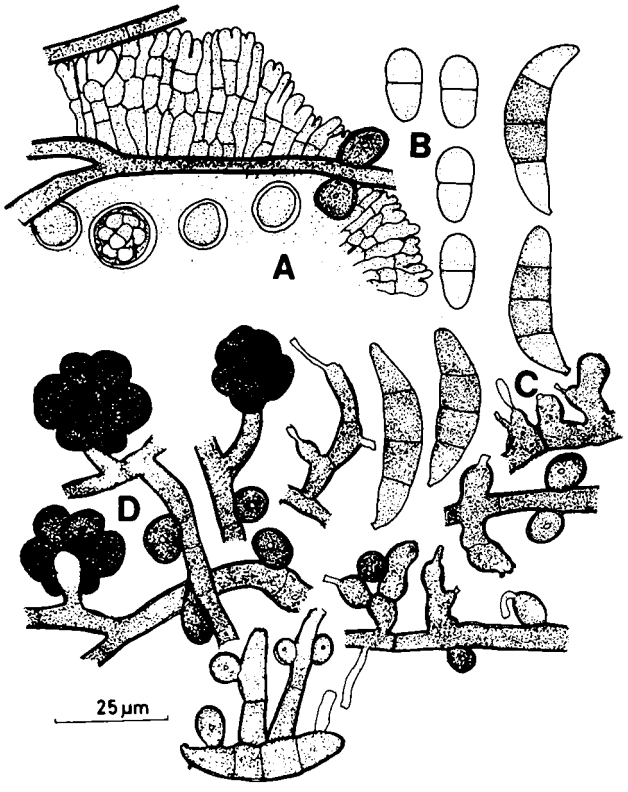


Fig. 173. *Clypeolella ricini* (type). A, portion of thyriothecium; B, ascospores; C, *Mitteriella* state; D, *Sarcinella* state.

C. ricini Racib. in Theiss., *Centralb. Bakt.* 2, **34:** 233, 1912 (Fig. 173).

Thyriothecia up to 70 µm broad. Asci 40-50 × 30-35 µm. Ascospores 16-19 × 7-9 µm. *Sarcinella* conidia up to 30 µm broad. *Mitteriella* conidia 3 septate, 28-45 × 8-10 µm.

On *Ricinus communis*. Africa, Asia.

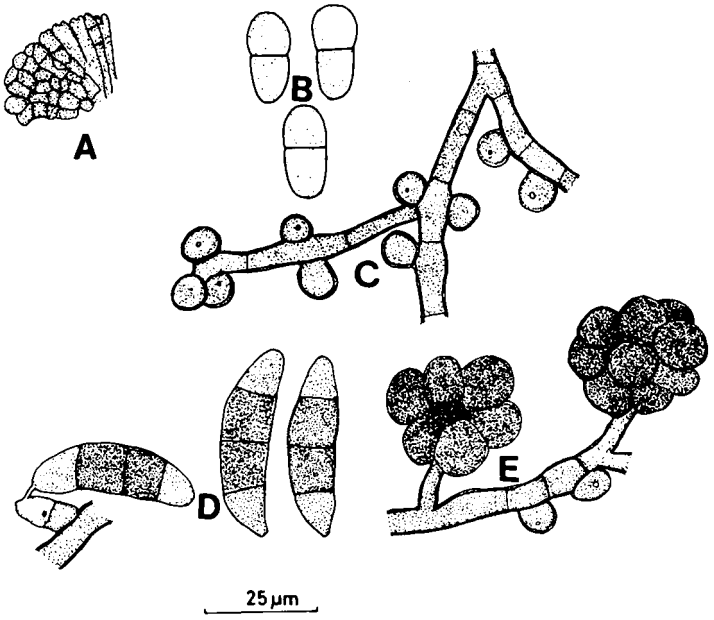


Fig. 174. *Clypeolella salaciae* (type). A, portion of thyriothecium; B, ascospores; C, mycelium; D, *Mitteriella* state; E, *Sarcinella* state.

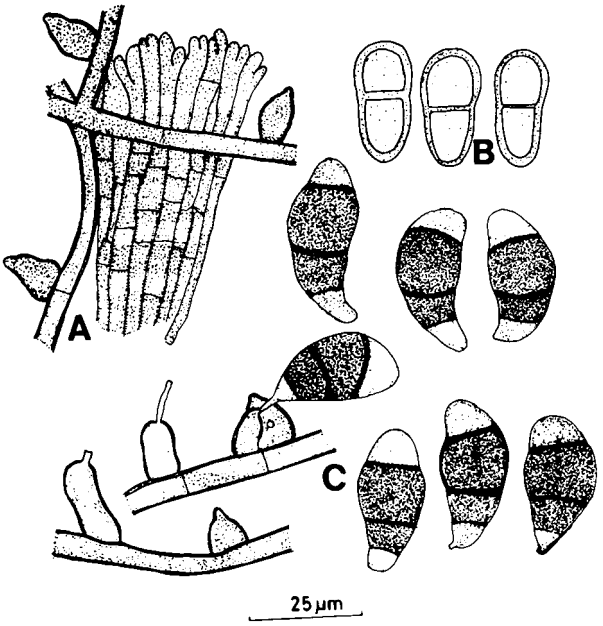


Fig. 175. *Clypeolella ugandensis* (type). A, portion of thyriothecium; B, ascospores; C, *Mitteriella* state.

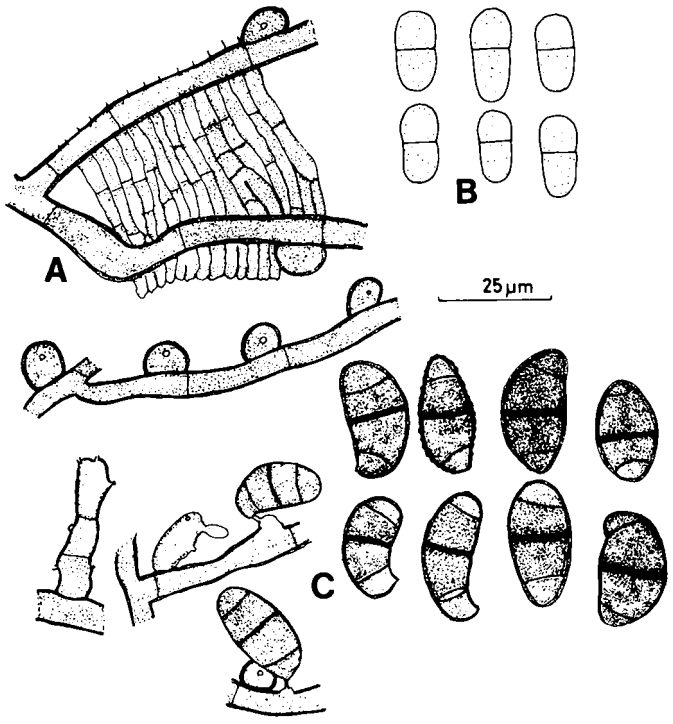


Fig. 176. *Clypeolella zizyphi* (type). A, portion of thyriothecium; B, ascospores; C, *Mitteriella* state.

C. salaciae Hansf., *Proc. Linn. Soc. Lond.* **157:** 31, 1945 (Fig. 174).

Thyriothecia up to 240 µm broad. Asci 40-50 × 25-30 µm. Ascospores 20-23 × 9-11 µm. Conidia 3 septate, 30-45 × 8-9 µm. *Sarcinella* conidia 30-35 µm broad.

On *Salacia* spp. Uganda.

C. ugandensis Hansf., *Proc. Linn. Soc. Lond.* **157:** 201, 1946 (Fig. 175).

Thyriothecia 300-600 µm broad. Asci 40-55 × 35-40 µm. Ascospores 26-32 × 12-15 µm. Conidia 3 septate, 30-37 × 15-19 µm.

On indet. Rubiaceae (?*Pavetta*). Uganda.

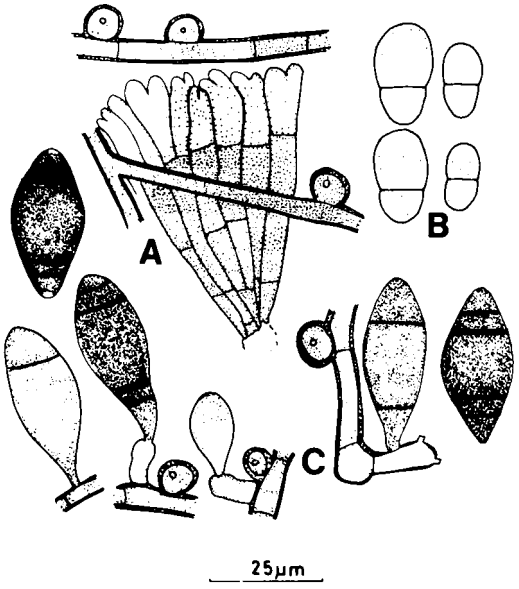


Fig. 177. *Clypeolella zizyphina* (type). A, portion of thyriothecium; B, ascospores; C, *Mitteriella* state.

C. zizyphi (Yates) Hansf., *Proc. Linn. Soc. Lond.* **160:** 152, 1949 (Fig. 176).

Asterina zizyphiae Yates, *Philipp. J. Sci.* **13:** 375, 1918.

Thyriothecia up to 170 µm broad. Ascospores 8-22 × 6-8 µm. Conidia 3 septate, 20-30 × 10-13 µm, smooth to verruculose.

On *Zizyphus*. Philippines.

C. ziziphina Mya Thaung, *Trans. Br. mycol. Soc.* **63:** 622, 1974 (Fig. 177).

Thyriothecia up to 260 µm broad. Asci 30-50 × 20-48 µm. Ascospores 16-24 × 8.5-12 µm. Conidia up to 4 septate, with dark brown to blackish brown central cells and subhyaline to pale brown end cells, 20-39 × 16-20 µm (*Mitteriella ziziphina*. Sydow).

On *Zizyphus*. Burma, India, Pakistan, Sudan, Uganda, Zambia.

EUPELTE H. Sydow, *Annls mycol.* **22:** 426, 1924.

Type sp.: *E. amicta* H. Sydow, *Annls mycol.* **22:** 426, 1924.

Anamorph: *Sporidesmium* sp. (Ellis, 1976).

Only two species known.

Mycelium partly superficial and partly immersed in the host. Superficial mycelium composed of a radiating network of sinuous, septate, non hyphopodiate, irregularly branched and anastomosing, pale brown to mid brown, smooth hyphae. Immersed mycelium composed of narrow, branched, septate, smooth, hyaline hyphae. Thyriothecia superficial, scattered over the colony, often away from the centre, dark brown, somewhat convex, orbicular to ellipsoidal, opening by an irregular fissure. The upper wall is composed of dark brown, radiating opaque cells which is fimbriate at the margin and the basal wall consists of a hyaline, septate, thin hyphal membrane. Asci numerous, cylindrical to clavate, 8 spored, subsessile, with a rounded thickened apex. Ascospores 2-3 seriate in the ascus, brown, oblong, 1 septate, constricted at the septum, smooth, with a slightly broader upper cell.

Conidiophores arising singly from the sides of the superficial hyphae or hyphae radiating from a thyriothecium and from normal hyphal cells, composed of rather broad, dark cells, erect or ascending, simple, smooth, straight, brown to very dark brown, 0-4 septate, Conidia blastic, formed singly at the apex of the conidiophore, straight or curved, cylindrical to obclavate, rounded at the apex, truncate at the base, 3-5 septate, not or slightly constricted at the septa, brown to dark brown, smooth to verruculose.

The connections are based on strong circumstantial evidence, the concurrence of thyriothecia and the anamorph, but are not yet proved by ascospore cultures.

This genus is very close to *Maurodothina* from which it differs in the absence of conidiogenous hyphopodia. Arx & Müller (1975) have placed *Maurodothina* as a synonym of *Eupelte*.

Key to Eupelte species

Conidia 3-5 septate, smooth, not constricted at the septa, without any hyaline band..... *E. rapaneae*

Conidia 2-4 septate, smooth to verruculose, not constricted at the septa, with a hyaline band on the apical cell..... *E. amicta*

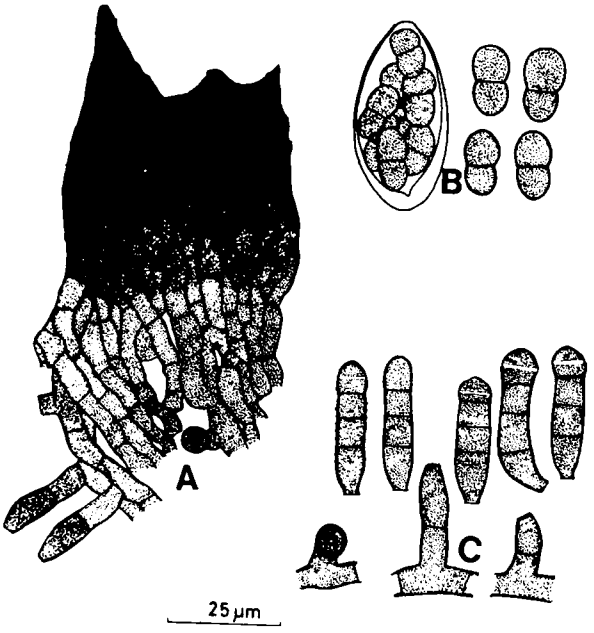


Fig. 178. *Eupelte amicta*. A, portion of thyriothecium; B, ascus and ascospores; C, conidiophores and conidia.

E. amicta H. Sydow, *Annls mycol.* **22:** 426, 1924 (Fig. 178).

Anamorph: *Sporidesmium* sp.

Thyriothecia up to 160 µm broad. Asci 45-55 × 20-25 µm. Ascospores 17-21 × 9-11 µm.

Conidiophores arising from unspecialised hyphal cells, 0-1 septate, up to 25 µm long and up to 9 µm thick. Conidia mostly 3-4 septate, not constricted, smooth to verruculose, with the apical cell wider than the others and containing a hyaline central band, 28-65 × 9-11 µm.

On leaves of *Olea laurifolia* and *O. cuspidata*. India, South Africa.

E. rapaneae Hansf., *Proc. Linn. Soc. Lond.* **158:** 43, 1947 (Fig. 179).

Anamorph: *Sporidesmium* sp.

Thyriothecia up to 150 µm broad. Asci 20-60 × 20-25 µm. Ascospores 17-20 × 9-12 µm.

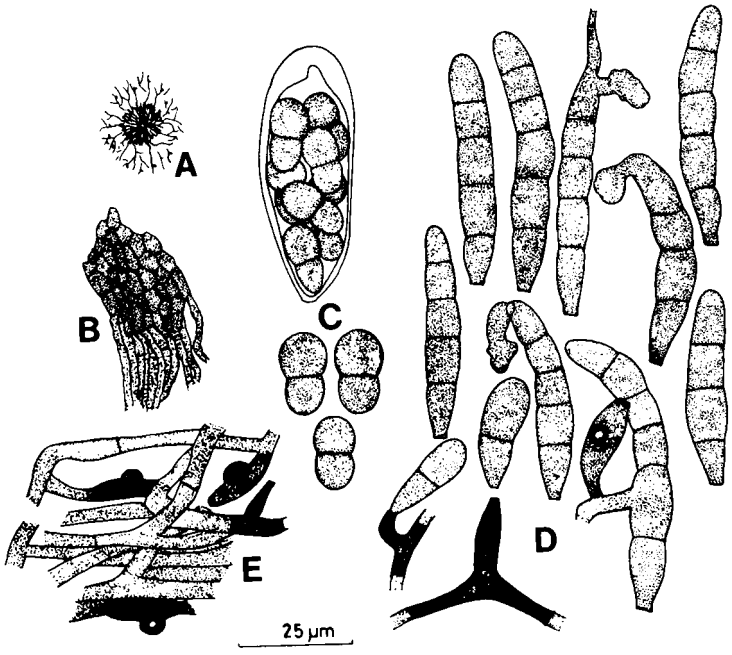


Fig. 179. *Eupelte rapaneae* (type). A, thyriothecium; B, portion of thyriothecium; C, ascus and ascospores; D, conidiophores and conidia; D, mycelia.

Conidiophores arising from rather broad, dark cells, 0-1 septate, 5-30 × 4-6 µm. Conidia 3-5 septate, constricted at the septa, smooth, 40-70 × 8-10 µm, germinating into hyphopodia.

A similar type of conidiophore and conidial production is also seen in *Placosoma nothopanacis*.

On upper surface of the leaves of *Rapanea pulchra*. Zaire.

MAURODOTHINA (Arnaud) Piroz. & Shoem., *Can. J. Bot.* **48:** 1326, 1970.

Type sp.: *M. dothideoides* (Ell. & Ev.) Piroz. & Shoem., *Can. J. Bot.* **48:** 1326, 1970.

Anamorph: *Pirozynskia* Subram. (1972).

Colonies foliicolous, effused, black. Mycelium partly superficial and partly immersed in the substrate. Immersed mycelium aggregated into subcuticular or substomatal plectenchymatous stromata or ramifying

through the mesophyll. Superficial mycelium composed of brown, branched, anastomosing hyphae radiating from a centrally located thyriothecium and bearing conidiogenous hyphopodia. Hyphopodia alternate or unilateral, subglobose, thick-walled, dark brown, slightly darker than the hyphae, becoming ellipsoid to subcylindrical, forming a single conidium through an apical pore. Conidia tretic, brown, coarsely verrucose, at first continuous, becoming one septate in the middle, constricted at the septum, with or without hyaline bands in each cell, beaked or not beaked.

Thyriothecia discrete or confluent, more or less rounded or broadly elliptical, irregular or hysteriform, composed of a thin basal membrane and a shield-shaped cover of dark brown, opaque cells arranged more or less in irregular radial rows, sometimes fimbriate at the margin, opening by irregular striate fissure. Asci ellipsoid to ovoid or subglobose, 8 spored. Ascospores initially hyaline, later brown, ovoid to ellipsoid, septate in the middle, with or without hyaline bands in each cell, constricted at the septum, smooth or verruculose. Pseudoparaphyses deliquescent, subhyaline to pale brown.

Only two species known (Pirozynski & Shoemaker, 1970).

Key to Maurodothina species

Ascospores 17-20 × 7-9 μm, conidia beaked, 30-40 × 10-14 μm..... ..... *M. dothideoides*

Ascospores 9-13 × 5-6 μm, conidia not beaked, 11-18 × 6.5-8 μm... *M. farriae*

M. dothideoides (Ell. & Ev.) Piroz. & Shoem., *Can. J. Bot.* **48:** 1326, 1970 (Fig. 180).

Asteridium dothideoides Ell. & Ev., *Bull. Torrey Bot. Club* **22:** 436, 1895.
Morenoëlla dothideoides (Ell. & Ev.) Höhnel, *Sber. Akad. Wiss. Wien* **118:** 7, 1909.
Eupelte dothideoides (Ell. & Ev.) von Arx & E. Müller, *Stud. Mycol.* **9:** 44, 1975.

Thyriothecia up to 300 μm broad. Asci 30-40 × 18-21 μm. Ascospores 17-20 × 7-9 μm with hyaline band in each cell, smooth. Conidia beaked, 30-40 × 10-14 μm, with hyaline bands.

On leaves of *Andromeda ferruginea*. U.S.A.

M. farriae Piroz. & Shoem., *Can. J. Bot.* **48:** 1327, 1970 (as '*farrae*') (Fig. 181).

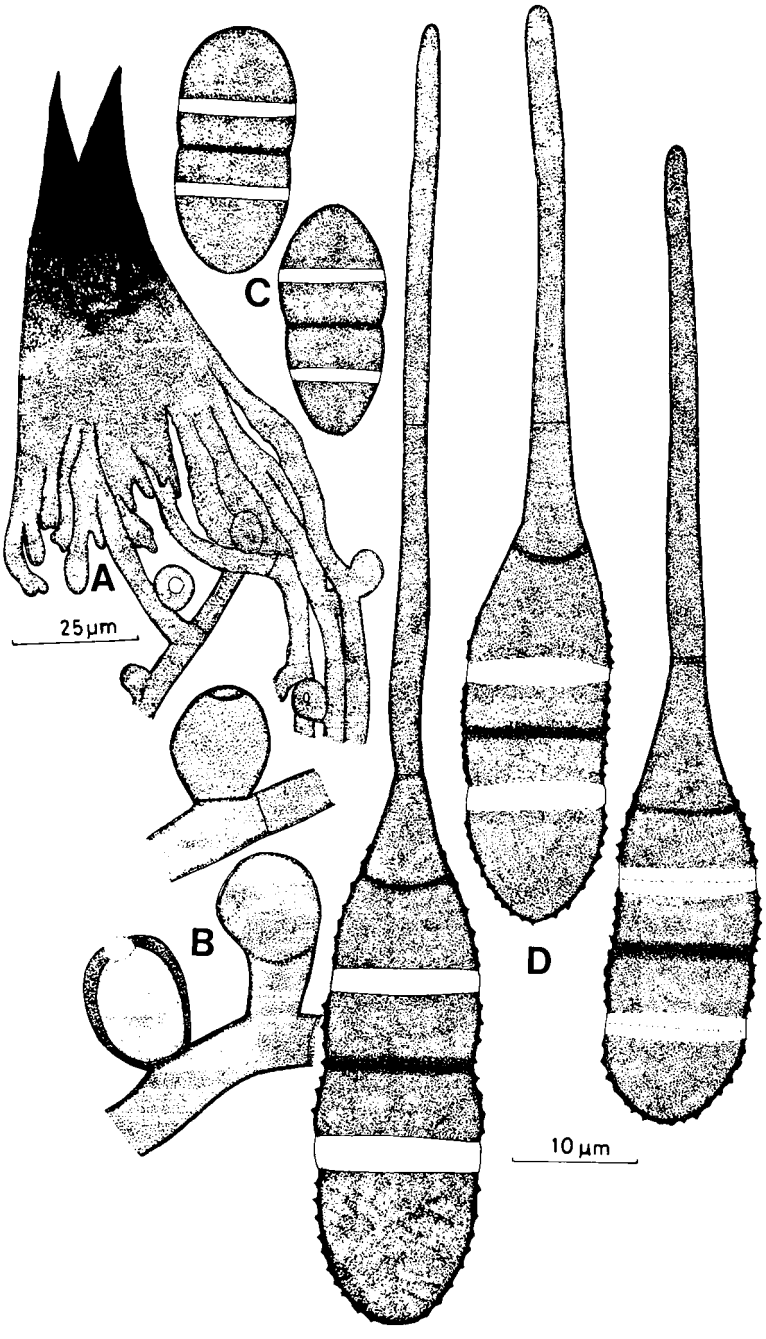


Fig. 180. *Maurodothina dothideoides* (type). A, portion of thyriothecium; B, hyphae with conidiogenous hyphopodia; C, ascospores; D, conidia.

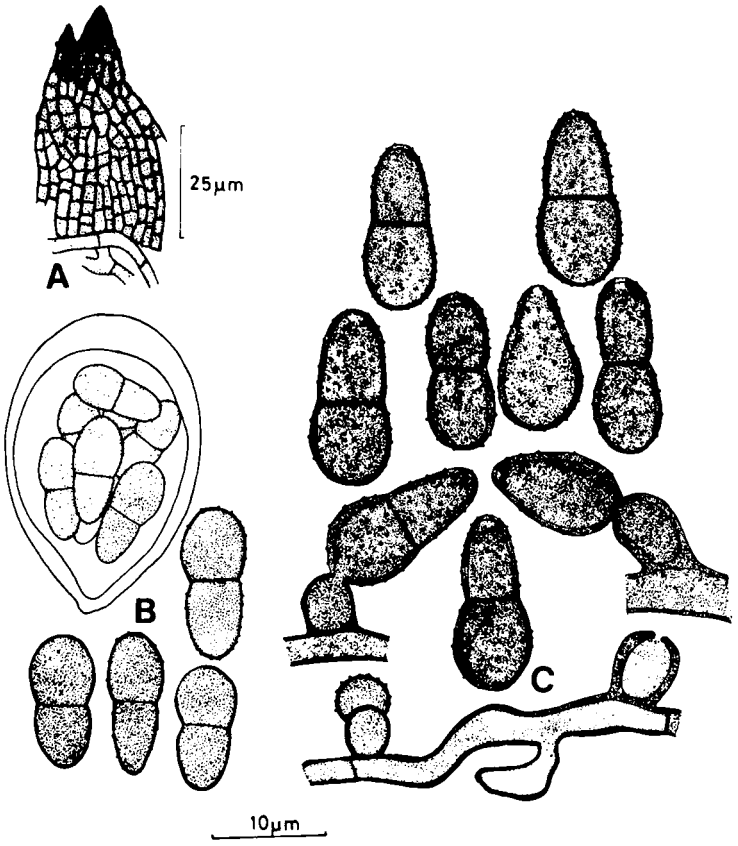


Fig. 181. *Maurodothina farriae* (type). A, portion of thyriothecium; B, ascus and ascospores; C, conidiogenous hyphopodia and conidia.

Eupelte farriae (Piroz. & Shoem.) von Arx & E. Müller, *Stud. Mycol.* **9:** 44, 1975, as *'farrae'*.

Anamorph: *Pirozynskia farriae* Subram., *Curr. Sci.* **41:** 711, 1972.

Thyriothecia up to 200 µm broad. Asci 25-40 × 12-20 µm. Ascospores 9-13 × 5-6 µm, smooth to verruculose. Conidia ovoid, coarsely verruculose, one septate, constricted at the septum, thick-walled, dark brown, 11-18 × 6.5-8 µm.

On living needles of *Abies* and *Thuja*. N. America.

MORENOINA Theiss., *Annls mycol.* **11:** 434, 1913.

Aulographella Höhnel, *Annls mycol.* **15:** 367, 1917.

Type sp.: *M. antarctica* (Speg.) Theiss. *Annls mycol.* **11:** 434, 1913.

Anamorph: *Sirothyriella* Höhnel, pycnothyrial state (J.P. Ellis, 1980).

About twelve species (Müller & von Arx, 1962; J.P. Ellis, 1980). Three species have been described by J.P. Ellis (1980) with pycnothyrial states from Britain and she has given full descriptions and illustrations of eleven species occurring in Britain of which nine have been described as new.

Mycelium superficial, sometimes sparse and easily rubbed off in older colonies, quite abundant in a few species. Thyriothecia elongate, simple or branched to become Y-shaped, X-shaped or irregularly lobed. Scutellum brown, darker towards the centre and composed of radiately arranged more or less rectangular to square cells. At the margin, the cells vary considerably in different species. The scutellum splits longitudinally at maturity to expose the numerous asci. Asci arranged vertically beneath the scutellum with their bases attached to a very thin basal plate of hyaline to pale brown, radially arranged cells. Asci variable in shape, spherical, ovoid or clavate, 8 spored, embedded in a slimy mass. Ascospores 1 septate, initially hyaline and guttulate, at maturity often becoming faintly brown, smooth to minutely verruculose, ends rounded and the upper cell a little wider than the lower cell. Pseudoparaphyses absent.

Pycnothyria orbicular, radially scutellate. Conidiogenous cells holoblastic, simple, hyaline. Conidia hyaline, cylindrical, one celled. Pycnothyria are connected directly by hyphae to the thyriothecia.

Morenoina species with anamorphs

M. paludosa J.P. Ellis, *Trans. Br. mycol. Soc.* **74:** 304, 1980 (Fig. 182 A,B,C).

Mycelium scanty, hyphae where present hyaline to straw-coloured. Thyriothecia simple to much branched, 160-800 × 60-100 μm, but when confluent and many lobed the area covered is greater. Scutellum composed of deep brown almost square cells becoming longer and paler at the edge. Asci 20-28 × 10-13 μm. Ascospores hyaline to pale brown, often sparsely verruculose when mature, 9-11.5 × 3-4 μm.

Pycnothyria orbicular, up to 400 μm broad. Scutellum composed of brown, almost square cells. Conidia hyaline, cylindrical, 5-7 × 1.5-2 μm.

On leaves and culms of *Agrostis, Bromus, Carex Cladium* and *Juncus*. Britain.

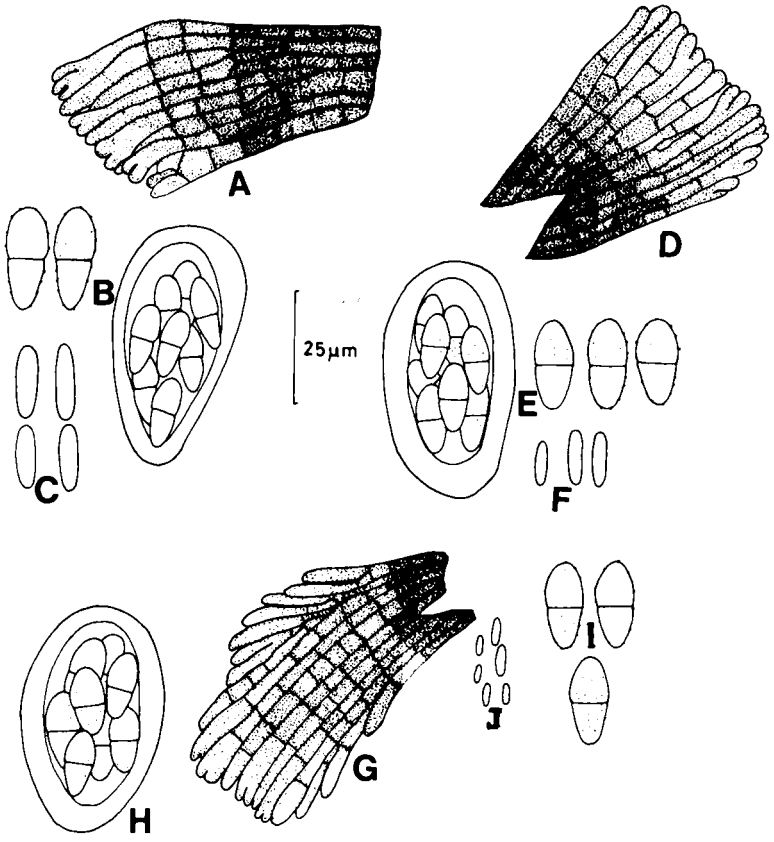


Fig. 182. *Morenoina paludosa* (type). A, portion of thyriothecium; B, ascus and ascospores; C. conidia. *M. phragmitis* (type). D, portion of thyriothecium; E, ascus and ascospores; F, conidia. *M. rhododendri* (type). G, portion of thyriothecium; H, ascus; I, ascospores; J, conidia.

M. phragmitis J.P. Ellis, *Trans. Br. mycol. Soc.* **74:** 304, 1980 (as *'phragmitidis'*) (Fig. 182D,E,F).

Mycelium sparse, hyphae olivaceous to pale brown. Thyriothecia simple or branched, 320-700 × 80-160 µm, when multibranched and confluent up to 700 µm long. Scutellum opaque in the centre, marginal cells olivaceous brown, elongate and finely divided. Asci 20-30 × 10-13 µm. Ascospores hyaline to straw coloured, often minutely verruculose, 8-10 × 10-13 µm.

Pycnothyria orbicular, pale brown, up to 200 µm broad. Conidia hyaline, cylindrical, 3-4 × 0.5-1 µm.

On dead culms of *Arundanaria, Phalaris* and *Phragmites*. Britain.



Fig. 183. *Placosoma nothopanacis.* A, superficial hyphae with setae and conidiophores; B, subcuticular hyphal plate.

M. rhododendri J.P.Ellis, *Trans. Br. mycol. Soc.* **74:** 305, 1980 (Fig. 182G,H,I,J).

Mycelium sparse. Hyphae olivaceous to pale brown. Thyriothecia simple or branched, 300-400 × 60-120 µm, sometimes confluent. Scutellum opaque at the centre, red brown at the margin, non fimbriate. Asci 16-20 × 8-13 µm. Ascospores 8-10 × 3-4 µm, hyaline to pale brown, smooth to minutely and sparsely verruculose.

Pycnothyria orbicular, straw coloured to pale brown, up to 100 µm broad. Conidia hyaline, cylindrical, 2-3 × 0.5-1 µm.

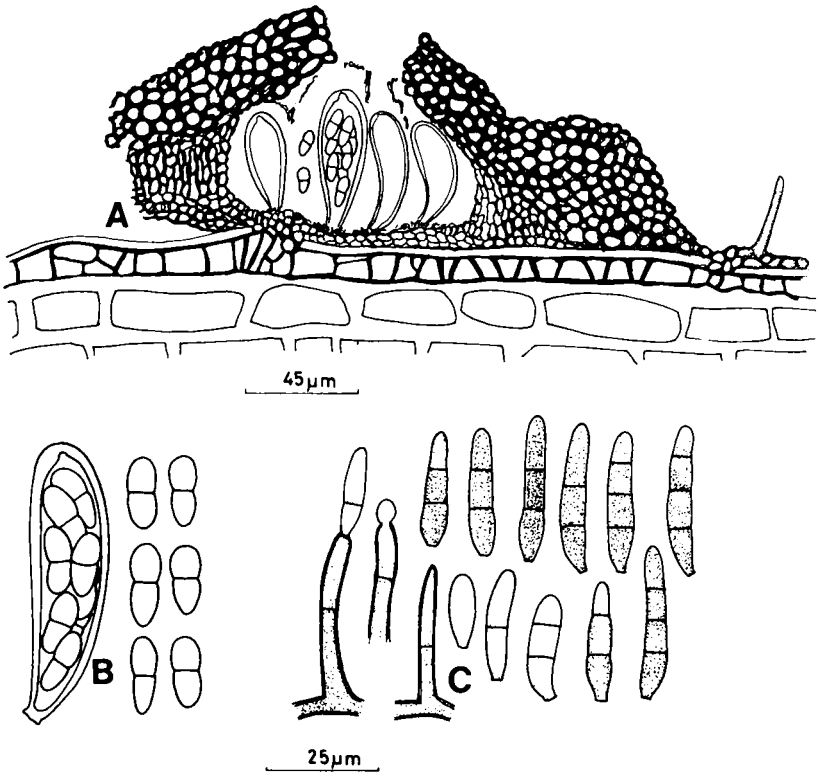


Fig. 184. *Placosoma nothopanacis.* A, v.s. ascostroma; B, ascus and ascospores; C, conidiophores and conidia.

On dead twigs and leaves of *Laurus nobilis, Rhododendron ponticum, Rubus fruticosus* and *Vaccinium myrtillus.* Britain.

PLACOSOMA H. Sydow, *Annls mycol.* **22:** 302, 1924.

The genus is monotypic.

P. nothopanacis H. Sydow, *Annls mycol.* **22:** 303, 1924Figs. 183 & 184).

Ascostromata superficial, circular to elliptical to Y shaped, scattered or arranged concentrically and peripherally, flattened conical, the outer layer of the thick dark outer wall is radiate and extends beyond the margin as a fringe, opening by linear or stellate fissure, 220-280 µm

broad and 70-100 μm high. The wall is sometimes united peripherally with the subcuticular hyphae which have penetrated the cuticle. Asci oblong ovoid, 8 spored, 35-60 × 20-24 μm. Ascospores one septate, with an upper cell slightly wider and shorter than the lower, hyaline becoming brown with age, 17-20 × 7-9 μm. Pseudoparaphyses abundant, hyaline, filiform, branched, deliquescing.

Mycelium superficial and immersed, hyphae radiating, anastomosing to form a circular network, pale to dark brown, up to 5.5 μm wide. Superficial hyphae bear erect, more or less cylindrical, dark brown, septate setae and conidiophores up to 90 μm long and 4-5 μm wide. Conidia blastic, solitary on the apex of the conidiophore and on a few successive percurrent proliferations which occur after conidium secession. Occasionally a conidium has a scar at each end. Conidia brown to dark brown, narrowly more or less obclavate, constricted at the 2 or 3 septa, narrowed towards the darker basal scar, longitudinally somewhat striate, 25-43 × 5.6-7.3 μm. Conidiophores producing conidia generically similar are also found in *Eupelte rapaneae* Hansf. (Hughes, 1978).

The connection is based on the repeated occurrence of the ascostroma with the anamorph.

On *Neopanax arboreum, N. colensoi.* New Zealand.

ULEOTHYRIUM Petrak, *Annls mycol.* **27:** 388, 1929.

The genus is monotypic.

U. amazonicum Petrak, *Annls mycol.* **27:** 388, 1929 (Fig. 185).

Anamorph: *Septothyrella uleana* H. & P. Sydow, *Annls mycol.* **14:** 96, 1916.

Mycelium superficial, hypophyllous, composed of densely branched, septate, olivaceous brown hyphae, 3-4 μm thick. Ascostroma mixed with pycnidia, elongate to ellipsoidal, usually two or more fused or close together, 200-350 × 100-150 μm, at maturity opening by a longitudinal slit. The wall is composed of textura radiata. The basal wall is made up of subhyaline, fibrous cells and the upper wall of carbonaceous, radial, thick-walled, dark to black brown cells. The margin is somewhat radiate with cells forming hyphal extensions. Asci numerous, 8 spored, rarely 4-6 spored, clavate to ellipsoidal, thick-walled, 30-38 × 15-18 μm. Ascospores elongate fusoid, rarely more or less clavate, parallel in the

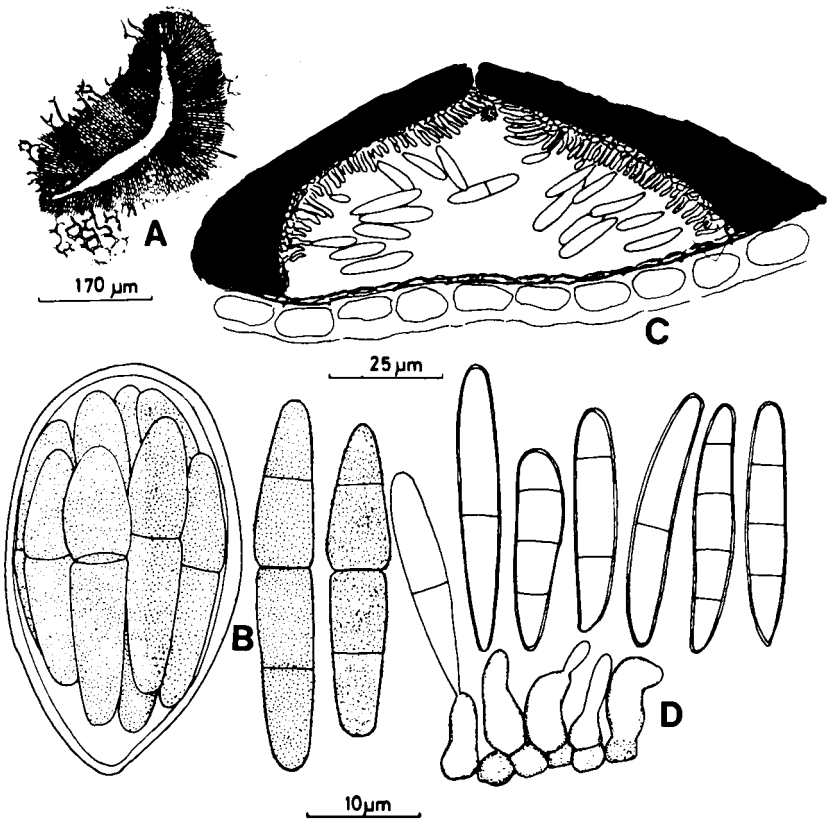


Fig. 185. *Uleothyrium amazonicum*. A, thyriothecium; B, ascus and ascospores; C, v.s. pycnidium; D, conidiophores and conidia.

ascus, straight or slightly curved, 3(-5) septate, hyaline to brown, sometimes slightly constricted at the septa, 24-32 × 3-5 µm. Pseudoparaphyses mucilaginous.

Pycnidia dimidiate-scutate, densely aggregated, rounded, 85-150 µm broad, crusty, with a pore 10-15 µm wide. The wall is of textura radiata. Conidiogenous cells cylindrical, flask-shaped, hyaline with brown wall, smooth to lightly verruculose, one celled, holoblastic. Conidia 1-3(4) septate, cylindrical to cylindric-clavate, not constricted at the septa, hyaline, 18-25 × 3-4 µm.

On leaves of *Salacia* spp. Brazil.

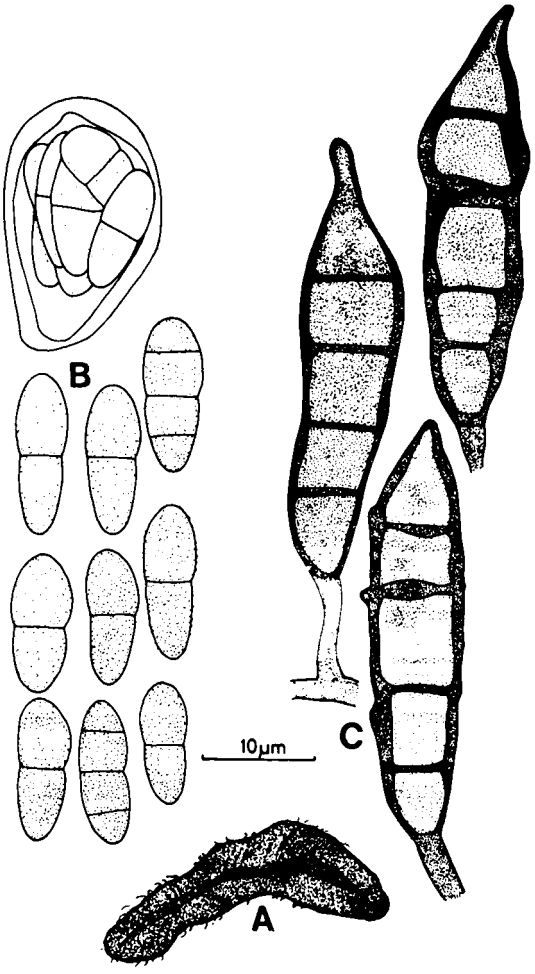


Fig. 186. *Yamamotoa carluduvicae.* A, thyriothecium; B, ascus and ascospores; C, conidiophores and conidia.

YAMAMOTOA Bat., *Publ. Inst. Micol. Recife* **291:** 11, 1960.

Peresiopsis Bat., *Publ. Inst. Micol. Recife* **291:** 23, 1960.

Type sp.: *Y. bomjardinensis* Bat., *Publ. Inst. Micol. Recife* **291:** 11, 1960.

Anamorphs: *Mitteriella* and *Clasterosporium.*

Two species are known to have anamorphs. The connection between teleomorph and anamorph is only through common mycelia and has yet to be proved by ascospore cultures.

Colonies amphigenous scattered to confluent, olivaceous brown. Superficial mycelium septate, branched, hyphopodiate. Thyriothecia superficial dark brown to black, elongate linear to lobed, opening by longitudinal fissure, with hyphae radiating from the margin. Internal mycelium if present hyaline, septate. Asci ellipsoid, subglobose or pyriform, 2-8 spored. Ascospores one septate, may become up to 3 septate after discharge, constricted at the septum, pale brown to brown when mature. Pseudoparaphyses filiform, hyaline.

Y. carluduvicae (Bat.) von Arx & E. Müller, *Stud. Mycol.* **9:** 44, 1975 (Fig. 186).

Peresiopsis carluduvicae Bat., *Publ. Inst. Micol. Recife* **291:** 23, 1960.

Anamorph: *Clasterosporium* sp.

Thyriothecia up to 780 μm long. Hyphopodia unilateral, 0-1 septate, cylindrical, straight or curved. Asci 8 spored, 26-32 × 12-14 μm. Ascospores cylindrical to clavate, 12-15 × 4-5 μm, sometimes becoming 3 septate, smooth to lightly echinulate, pale brown.

Conidia dark brown, cylindric-fusiform, 4-6 (mostly 4) septate, thick-walled, attenuating at the apex, truncate at the base, 35-50 × 10-12 μm, formed on monoblastic, terminal, integrated, smooth, conidiogenous cells arising from the hyphae.

On leaves of *Carluduvica palmata*. Panama.

Y. guarapensis Bat. & Maia in Bat., *Publ. Inst. Micol. Recife* **291:** 16, 1960 (Fig. 187).

Anamorph: *Mitteriella* sp.

Thyriothecia up to 700 μm long. Hyphopodia unilateral, alternate, one celled. Colonies mostly epiphyllous. Asci ellipsoid to subglobose, 8 spored, sessile, 22.5-33 × 10-12.5 μm. Ascospores ellipsoid oblong, 13.5-18 × 4.5-8 μm, smooth.

Mitteriella conidia 3-5 septate, dark brown, smooth, 20-25 × 10-12 μm. A spermatial pycnidial state has been reported for this species.

On leaves of *Roupala elegantis*. Brazil.

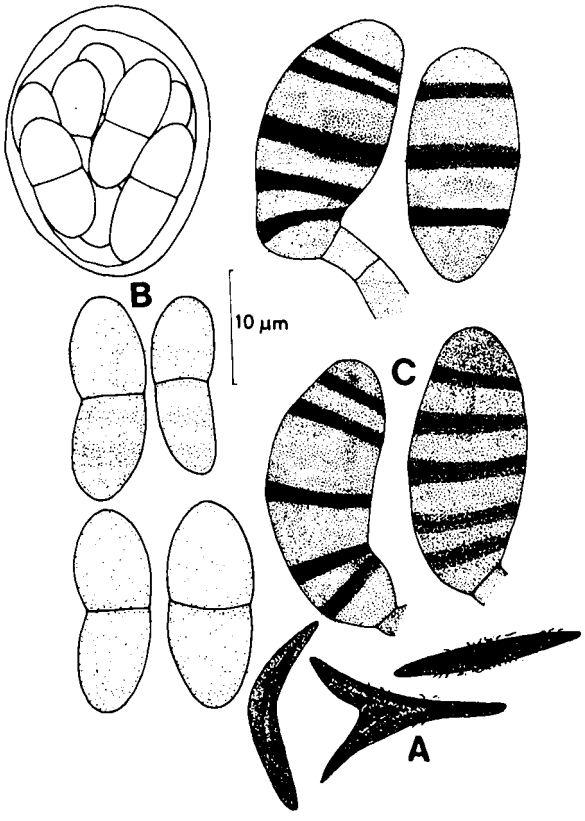


Fig. 187. *Yamamotoa guarapensis* (type). A, thyriothecia; B, ascus and ascospores; C, *Mitteriella* conidia.

Vizellaceae Swart

Superficial hyphae lacking, mycelium intracuticular. Thyriothecia subcuticular, dimidiate-scutate or crustose, in section rounded to elongate, opening by crumbling or fissure. Ascospores one celled or with a small appendage-like cell at the base, with a light coloured band around the middle or just above the middle, brown. Pseudoparaphyses filamentous or may be sparse. Leaf-inhabiting ascomycete growing on or under the cuticle.

Anamorphs: *Manginula* Arnaud (Hughes, 1953) or *Manginula*-like (Swart, 1971; Sivanesan, 1973).

VIZELLA Sacc., *Syll. Fung.* **2:** 662, 1883.

Entopeltis Höhnel, *Sber. Akad. Wiss. Wien* **119:** 420, 1910.
Phaeopeltis Petch, *Ann. R. bot. gens Peradeniya* **7:** 33, 1919 non Clem. 1909.
Stigmatopeltis Doidge, *Bothalia* **2:** 232, 1927.
Hypocelis Petrak, *Annls mycol.* **27:** 27, 1929.
Phaeaspis Clem. & Shear, *The Genera of Fungi:* 100, 304, 1931.

Müller & von Arx (1955) regarded all species described under these genera as identical to the type except *Entopeltis* which they kept as a separate genus.

Type sp.: *V. appendiculosa* (Mont. & Berk.) Theiss., *Broteria Ser. Bot.* **12:** 20, 1914.

Colonies epiphyllous, growing in the cuticle. Hyphae ribbon-like consisting of hyaline cells alternating usually in pairs with much shorter dark cells or without thickened septa. Thyriothecia disc-shaped with upper wall of irregularly arranged cells. Asci arranged radially around a central column, 8 spored. Ascospores biseriate, one celled or with a small appendage-like basal cell, brown with a light coloured band around the middle or just above the middle. Pseudoparaphyses present in young thyriothecia.

Key to Vizella species with anamorphs

Ascospores without appendage-like basal cell, 15-20 × 9-15 μm, conidia without hyaline band..... *V. pycnanthi*

Ascospores with appendage-like basal cell, conidia with or without hyaline band 1

1. Ascospores 14-16 × 8-10 μm, conidia with two transverse hyaline bands..... ..... *V. hendrickxii*

Ascospores 11-14 × 5.5-7 μm, conidia without hyaline band.... *V. oleariae*

V. hendrickxii (Hansf.) S. Hughes, *Mycol. Pap.* **50:** 99, 1953.

Entopeltis hendrickxii Hansf., *Proc. Linn. Soc. Lond.* **158:** 41, 1947.

Anamorph: *Manginula* sp. (Hughes, 1953).

Thyriothecia subcuticular, epiphyllous up to 130 μm diam. Asci ellipsoidal to saccate, 60-75 μm. Ascospores conglobate, ovoid, dark brown, 14-16 × 8-10 μm, with a light coloured band around the middle and a subhyaline appendage-like cell at the base.

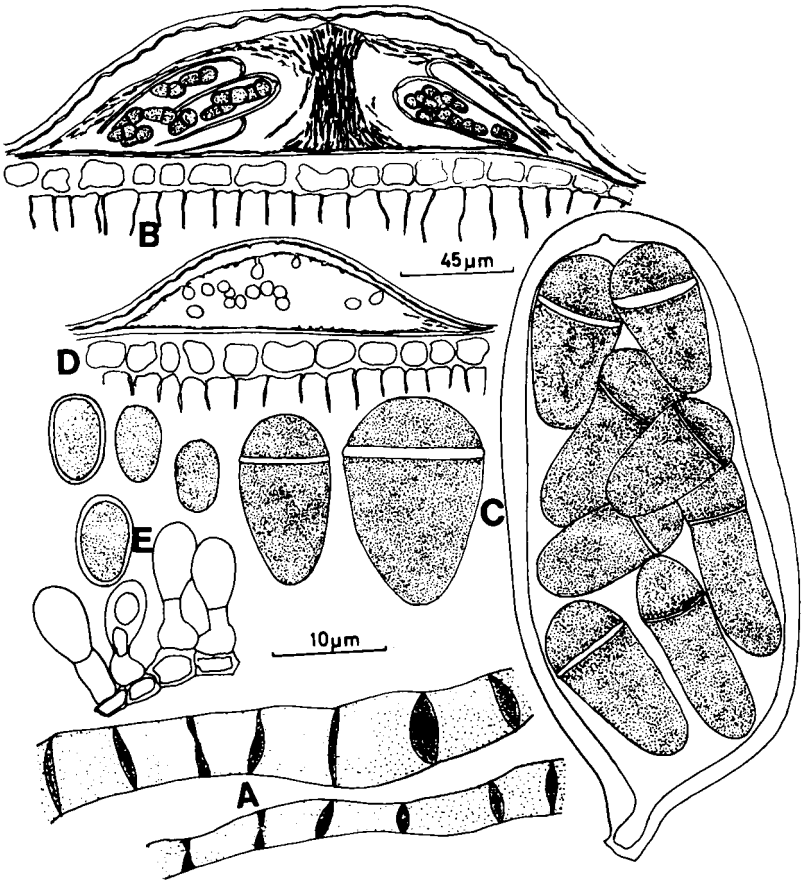


Fig. 188. *Vizella pycnanthi* (type). A, hyphae; B, v.s. thyriothecium; C, ascus and ascospores; D, v.s. pycnidium; E, conidia.

Pycnidia similar to thyriothecia. Conidia ovoid, brown, 13-15 × 6-7.5 µm, with two transverse hyaline bands, formed on phialidic, hyaline cells lining the inner cavity of the upper wall.

On leaves of *Rauwolfia* spp. Zaire.

V. olearíae Swart, *Trans. Br. mycol. Soc.* **57:** 462, 1971.

Thyriothecia epiphyllous, up to 150 µm diam. Asci 45 × 15 µm. Ascospores 11-14 × 5.5-7 µm with a transverse hyaline band above the middle and a basal small appendage-like cell, brown.

Pycnidia similar to thyriothecia. Conidia hyaline to brown, one celled, ellipsoid with somewhat truncate base, 6.5-9 × 4-5 μm formed on simple, hyaline, phialidic, rarely proliferating phialides formed from cells of the upper wall. Spermatia produced in the same manner as conidia, hyaline, cylindrical, 3-4 × 0.5-1 μm. The pycnidial state is *Manginula*-like.

On leaves of *Olearia argophylla*. Australia.

V. pycnanthi Sivan., *Trans. Br. mycol. Soc.* **60:** 587, 1973 (Fig. 188).

Thyriothecia epiphyllous, up to 200 μm diam. Asci 60-95 × 25-32 μm. Ascospores one celled, brown when mature, 15-20 × 9-15 μm, with a hyaline transverse band just above the middle, without any appendage-like basal cell.

Pycnidia similar to thyriothecia. Conidia arising from simple, hyaline, phialidic cells, hyaline to brown, one celled, ellipsoid, 6.5-9 × 4.5-6.5 μm and similar to the pycnidial state of *V. oleariae*.

On leaves of *Pycnanthus angolensis*. Sierra Leone.

Myriangiales

Ascostromata small or large, pulvinate, subglobose or discoid, or forming extensive crusts, entirely superficial with a basal foot, intra- or sub-epidermal or partially erumpent. Asci scattered irregularly at different levels or forming a single layer of monoascus locules in the parenchymatic tissues, globose. Ascospores one or more septate or dictyoseptate. Pseudoparaphyses composed of often swollen hyphal elements or the stromatal tissues may be compressed between the asci and show a tendency to become paraphysoidal.

It includes a small number of genera occurring as epiphytes, saprophytes, parasites or hyperparasites on superficial fungi or scale insects on living leaves and stems or lichenized, mostly in the tropical or subtropical regions.

Key to families of Myriangiales

Thallus gelatinous, filaments of globose cells..... *Seuratiaceae*

Ascostroma pseudoparenchymatic or plectenchymatic or often a complex stroma..... *Myriangiaceae*

Seuratiaceae Vuillemin

Thallus large to medium sized, superficial to basally immersed, semiglobose or often lobed, gelatinous black or olivaceous brown, composed of a network of swollen cells. Asci in a single layer in specialized disc-shaped protrusions from the surface or in undifferentiated peripheral layer of the thallus. Ascospores mostly one septate, hyaline to brown. Pseudoparaphyses composed of swollen hyphal elements forming a crustose epithecium at the apex.

On insect honey dew on leaves and stems, often in association with sooty moulds, and easily recognised by their peculiar multicellular propagules in specialised portions of the thallus surface.

SEURATIA Pat., *Bull. Soc. mycol. Fr.* **20:** 136, 1904.

Atichia (*sensu*) Racib., *Paras. Algen und Pilze Javas* **3:** 41, 1900.
Atichiopsis Wagner in Linsbaur, *Oesterr. Bot. Z.* **50:** 305, 1900.
Phycopsis Mangin & Pat., *C.R.Acad. Sci. Paris* **154:** 1480, 1912.
Euthrypton Theiss., *Verh. K.K. Zool.-Bot. Ges. Wien* **66:** 323, 1916.
Phaeophycopsis Bat. & Peres, *Atas Inst. Micol.* **4:** 240, 1967.
Synonomy after Meeker (1975).

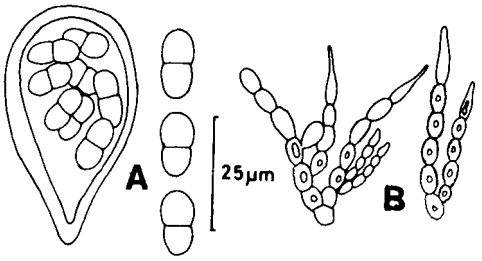


Fig. 189. *Seuratia millardetii.* A, ascus and ascospores; B, conidiophore and conidia.

Anamorph: *Atichia* Flotow

Colonies composed of filaments of globose or irregular cells embedded in a gelatinous matrix. Pseudothecia one to many per colony, variable in size, retaining interthecial tissue at maturity, sometimes covered by an epithecium. Asci produced by means of croziers, isolated or arranged in fascicles. Ascospores one septate, hyaline to brown. Asexual reproduction by means of multicellular holoblastic thallospores (conidia).

Epiphytic, saprobic, cosmopolitan.

Only the type species is briefly described here. For other species refer to Meeker (1975) who has accepted four species in *Seuratia.*

S. millardetii (Racib.) Meeker, *Can. J. Bot.* **53:** 2485, 1975 (Fig. 189).

Atichia millardetii Racib., *Paras. Algen und Pilze Javas* **3:** 41, 1900.
Atichiopsis solmsii Wagner, *Oesterr. Bot. Z.* **50:** 305, 1900, *nom provis.*
Seuratia coffeicola Pat., *Bull. Soc. mycol. Fr.* **20:** 136, 1904.
Seuratia pinicola Vuillemin, *Bull. Soc. mycol. Fr.* **21:** 76, 1905.
Atichia treubii Höhnel, *Ann. Jard. Bot. Buitenz* **3:** 27, 1910.
Atichia pinicola (Vuill.) Sacc. & Trotter in Sacc., *Syll. Fung.* **22:** 770, 1913.
Capnodium stellatum Bernard, *Bull. Dep. Agric. Indes Néerl.* **11:** 1, 1907.
Atichia dominicana Cotton, *Kew Bull.* **1914:** 62, 1914.
Phycopsis treubii Boedijn, *Bull. Jard. Bot. Buitenz* ser. 3, **11:** 228, 1931.
Atichia botriosa Fraser, *Proc. Linn. Soc. N.S.W.* **61:** 281, 1936.
Atichia lopesii Bat., *Ann. Soc. Biol. Pernamb.* **15:** 319, 1957.
For further synonyms refer to Meeker, 1975.

Anamorph: *Atichia glomerulosa* (Ach.) Stein in Cohn, *Krypt.-Fl. Schlesien* **2:** 356, 1879.
For additional synonyms refer to Meeker, 1975.

Thallus up to 3 mm long. Asci 2-8 spored. Ascospores 11-25 × 4-10 μm. Macroconidia hyaline to dark, often two to three branched, the branches bearing secondary smaller branches, mostly in discrete sporodochia on the upper surface of the colonies. Microconidia aseptate, rod shaped, minute, formed in non ostiolate pycnidia.

On needles and branches of conifers and on numerous other hosts in the tropics.

Myriangiaceae Nyl.

Ascostromata pseudoparenchymatous or plectenchymatous, often stromatic complex, superficial or erumpent. Asci in monoascus locules scattered often at different levels. Ascospores dictyoseptate. Stromatic cells between asci may become flattened and elongated as pseudoparaphyses.

Parasites on leaves or stems, on scale insects or hyperparasites on other fungi.

The genus *Elsinoe* is only dealt with here. *Anhellia* Racib. and *Xenodium* H. Sydow are known to have *Sphaceloma*-like anamorphs (Kendrick, 1979).

ELSINOE Racib., *Parasit. Algen und Pilze Javas* **1:** 14, 1900.

Plectodiscella Woronichin, *Mycol. Cbl.* **4:** 232, 1914.
Isotexis H. Sydow in H. Sydow & Petrak, *Annls mycol.* **29:** 261, 1931.
Bitancourtia Thirum. & Jenkins, *Mycologia* **45:** 781, 1953.
Uleomycina Petrak, *Sydowia* **8:** 74, 1954.

Type sp.: *E. canavaliae* Racib., *Parasit. Algen und Pilze Javas* **1:** 14, 1900.

Anamorph: *Sphaceloma* de Bary (for generic synonyms see Sutton, 1980).

About forty species have been described mainly based on hosts and some are morphologically indistinguishable (von Arx, 1963; Jenkins & Bitancourt, 1941, 1942; Boedijn, 1961).

Lesions on leaves, stems and fruits, separate or confluent, variable in shape, mostly scab-like. Scabs irregularly discoid to subglobose, confluent, hyaline to pale brown. Ascomata scattered, globose, circular, elliptical or pulvinate, separate or aggregated, epidermal to subepidermal, composed of hyaline to pale brown, pseudoparenchymatic textura angularis. Asci distributed irregularly in the upper part of the ascoma,

ovoid, globose, subglobose or elliptical, thick-walled, 8 spored, sessile. Ascospores hyaline to pale yellow, transversely two or more septate, sometimes with one vertical septum in one or rarely two cells, usually slightly constricted at the middle septum.

Acervuli on leaves or stems, often coalescing, composed of textura angularis. Conidiophores infrequently formed, 1-3 septate, simple, cylindrical, hyaline to pale brown, formed from the upper cells of the acervulus. Conidiogenous cells enteroblastic, mono to poly-phialidic, indeterminate, integrated or discrete, hyaline to pale brown, ampulliform. Conidia hyaline, one celled, ellipsoid, smooth.

E. ampelina Shear, *Phytopathology* **19:** 677, 1929.

Anamorph: *Sphaceloma ampelinum* de Bary, *Ann. Oenologie* **4:** 165, 1874.

Ramularia ampelophaga Pass., *Bol. Com. Agr. Parmense* **9**(8): 125, 1876.
Gloeosporium ampelophagum (Pass.) Sacc., *Michelia* **1:** 217, 1878.
Manginia ampelina Viala & Pacottet, *C.R. Acad. Sci. Paris* **139:** 88, 1904.

Lesions on leaves, stems and fruits, separate or confluent, usually circular. Leaf lesions amphigenous with dark brown margin, centre pale, necrotic, often abscissing, surrounded by a chlorotic light green halo, up to 2.25 mm diam. On stems and fruits lesions larger, raised, with dark margin, cream brown, central tissue puckered or sunken, up to 5.5 mm diam., becoming split and eventually dropping out. Asci 15-28 × 12-25 μm. Ascospores 3 septate, 15-16 × 4-5 μm. Acervuli amphigenous, mostly epiphyllous, separate or confluent, composed of hyaline to pale brown pseudoparenchyma, epidermal to subepidermal, up to 60 μm diam. Conidiogenous cells formed directly from the upper cells of the pseudoparenchyma, monophialidic to polyphialidic, lacking a thickened region around the phialidic channel, terminal, integrated, determinate, hyaline to pale brown, 3.5-6 × 3-5.5 μm. Conidia (phialoconidia) hyaline, one celled, 4-7.5 × 2-3.5 μm.

On *Vitis* spp. It causes grape anthracnose, black spot of vine (spot anthracnose etc.) and birds eye rot (fruits). Widespread in most grape-growing areas where suitable rainfall occurs.

General symptoms may include: leaves - curling downwards, laceration of chlorosis of leaf parts and death of entire young leaf; shot-hole and premature leaf abscission; stems - stunting and death of young shoots, deterioration of older shoots and stocks, loss of fruit yield; fruits - loss of young bunches, and distortion, splitting, mummification or abscission of berries by direct attack on fruit surface.

Sivanesan & Critchett (1974a) have given a brief account of the morphology, disease, biology and control of this fungus.

E. australis Bitancourt & Jenkins, *Mycologia* **28:** 491, 1936.

Anamorph: *Sphaceloma australis* Bitancourt & Jenkins, *Mycologia* **28:** 491, 1936.

Sphaceloma fawcettii Jenkins var. *viscosa* Jenkins, *Phytopathology* **23:** 543, 1933.

Lesions on fruits, leaves and twigs, solitary or confluent, when fructicolous circular to irregular, raised, corky in texture and appearance, up to 4 mm diam., when foliicolous initially funnel-shaped pockets, later scab-like, smooth, glossy, up to 2 mm diam., amphigenous, especially along the midrib. Twig lesions resemble those on the leaf. Ascomata up to 150 μm diam. Asci 15-30 × 12-20 μm. Ascospores 1-3 septate, slightly constricted at the septa, but the upper middle cell may become longitudinally septate, 12-20 × 4-9 μm. Acervuli similar in appearance to ascomata. Conidiogenous cells formed directly from the upper cells of the pseudoparenchyma or from 0-3 septate conidiophores, hyaline to pale brown, monophialidic, terminal, integrated, determinate, 6-18 × 4-5 μm. Conidia hyaline, aseptate, 4-6 × 2-4 μm.

On sweet orange, lemon, mandarin, tangerine, satsuma orange, kumquat, lime, grapefruit and pointed leaf papeda. It causes the sweet orange scab. Symptoms mainly on fruits, less frequently on leaves, twigs. Only young tissues are attacked. Young fruits may be distorted.

Largely confined to South America. A brief account of the morphology, distribution, biology and control of this species has been given by Sivanesan & Critchett (1974b).

E. canavaliae Racib., *Parasit. Algen und Pilze Javas* **1:** 14, 1900 (Fig. 190).

Anamorph: *Sphaceloma* sp.

Ascoma subepidermal with isolated monoascus locules arranged randomly. Asci 16-24 × 20-30 μm. Ascospores elliptical, straight or curved, transversely 2-3 septate, hyaline or yellowish, 9-12 (28) × 2.9-3.5 (9) μm, slightly constricted at the septa.

According to Jenkins (1931) a *Sphaceloma* type of anamorph exists but she has not given any detailed description of it.

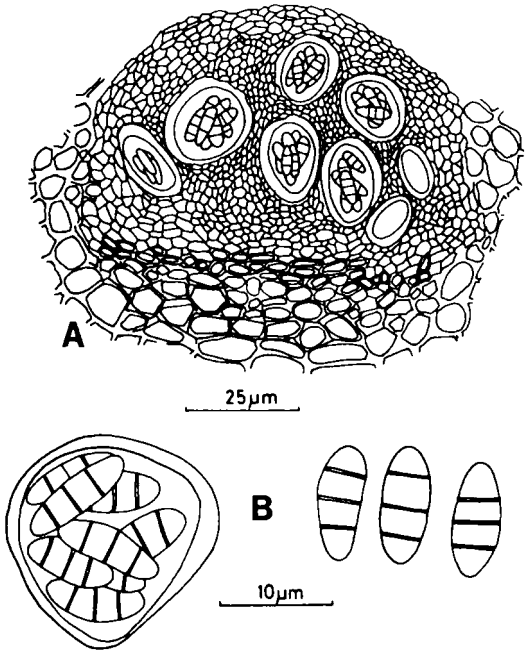


Fig. 190. *Elsinoe canavaliae*. A, v.s. stroma; B, ascus and ascospores.

The fungus causes scab of sword and jack beans. Leaf lesions circular or oblong, light brown, darker at the margin, up to 2 cm long and 6 mm wide, forming shot-holes. Stem lesions numerous, circular, elliptical or occasionally elongated up to 2 cm long, cinnamon brown and enveloping half the shoot circumference. The larger pod lesions, up to 3 mm diam., are circular, generally flat but sometimes raised or depressed. Galls occur due to an increase in size and number of cells of the spongy parenchyma.

It has been reported on *Canavalia gladiata, C. ensiformis* from Indonesia, Philippines, Singapore, Sri Lanka, Uganda, Zaire, Zambia (Sivanesan & Holliday, 1971a).

E. fawcettii Bitancourt & Jenkins, *Phytopathology* **26:** 394, 1936.

Anamorph: *Sphaceloma fawcettii* Jenkins, *Phytopathology* **15:** 99, 1925.

Lesions on leaves, twigs and fruits. Leaf lesions amphigenous, initially semi-translucent dots, becoming papillate, cream to pale yellow or

variously coloured, up to 3 mm diam. Scabs irregularly discoid to subglobose, confluent, mostly along the main veins, cinnamon to honey coloured, warty, deeply cracked and split when old, up to 1 mm diam. Fruits and young shoots may develop similar symptoms. Ascomata up to 120 μm wide. Asci 12-16 μm. Ascospores 1-3 septate, usually constricted at the central septum, 10-12 × 5-6 μm. Acervuli epidermal to subepidermal, separate or confluent, composed of hyaline to pale brown pseudoparenchyma. Conidiogenous cells formed directly from the upper cells of the pseudoparenchyma or from 0-2 septate conidiophores, monophialidic to polyphialidic, terminal, integrated, hyaline to pale brown, 12-22 × 3-4 μm. Conidia hyaline, one celled, ellipsoidal, 5-10 × 2-5 μm.

It causes the sour orange scab (common citrus scab), lemon, grapefruit scab etc. according to host and confined to a small number of genera and species within the Rutaceae. It is widespread in many citrus growing areas where suitable rainfall occurs (Sivanesan & Critchett, 1974c).

E. heveae Bitancourt & Jenkins, *Arch. Inst. Biol. Sao Paulo* **23:** 50, 1956.

Anamorph: *Sphaceloma heveae* Bitancourt & Jenkins loc. cit.

Lesions on young shoots and leaves. Ascospores 3-4 septate, often with one incomplete vertical septum, hyaline, 14-19 × 5-8 μm.

Acervuli immersed to erumpent, up to 50 μm broad. Conidia not easily seen.

On *Hevea brasiliensis*. South America.

E. phaseoli Jenkins in Bruner & Jenkins, *J. Agric. Res.* **47:** 788, 1933 (Fig. 191).

Anamorph: *Sphaceloma* sp.

Ascomata subepidermal, up to 140 μm wide. Asci 30-40 μm. Ascospores basal part sometimes more obtuse than the apical part, hyaline or pale yellow, transversely 3 septate, but one of the central cells may become longitudinally septate, somewhat constricted at the median septum, 13-15 × 5-6 μm. Conidiophores aggregated in the centre of young lesions or developed on marginal zones of older lesions, hyaline to dark, unbranched, blunt or pointed, continuous or 1 septate, 20 × 4 μm bearing conidia at their tips, closely compacted in more or less effuse minute acervuli. Conidia variable, some minute spherical up to 4 μm diam., others ovoid or oblong-elliptical, guttulate, hyaline to greyish, 10 × 4 μm.

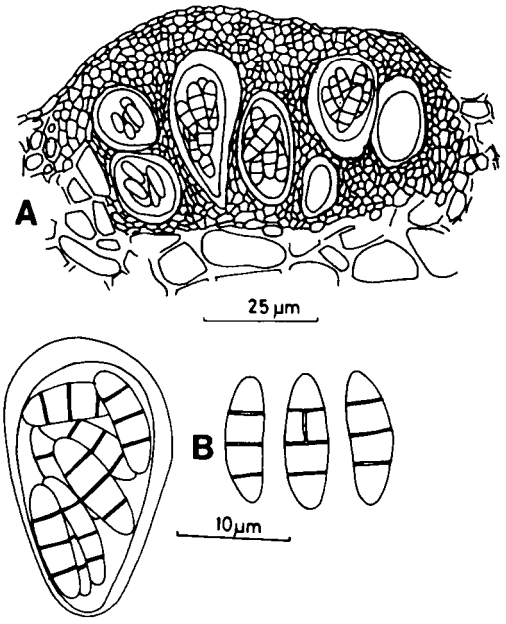


Fig. 191. *Elsinoe phaseoli.* A, v.s. of stroma; B, ascus and ascospores.

On *Phaseolus lunatus* and possibly on *P. vulgaris, Vigna sinensis* and *V. unguiculata.*

Scab of Lima bean. The symptoms are most conspicuous on the pods where the red to brown, raised or sunken lesions are up to 1 cm diam., somewhat elongate, usually irregularly distributed and sometimes occurring only on one valve; lesions do not penetrate to the seed. Leaf lesions are up to 4 mm diam. or larger near the veins, more pronounced on the upper surface and vinaceous buff or liver brown. Elongate lesions (sometimes bordered by a purple-brown band) may encircle the stem.

Occurs mainly in Central America and some of the West Indian Islands; also in Surinam, U.S.A and E. Africa (Sivanesan & Holliday, 1971b).

E. piri (Woronichin) Jenkins, *J. Agric. Res.* **44:** 696, 1932.

Plectodiscella piri Woronichin, *Mycol. Cbl.* **4:** 232, 1914.
Uleomyces piri (Woronichin) Jenkins, *J. Agric. Res.* **44:** 696, 1932.
Micropeltis piri Camara & Luz, *Agron. lusit.* **1:** 178, 1939.

Anamorph: *Sphaceloma pirinum* (Pegl.) Jenkins, *Phytopathology* **36:** 458, 1946.

Gloeosporium pirinum Peglion, *Riv. Patol. Veg.* **3:** 267, 1894.
Melanobasidium mali Maubl., *Bull. Soc. mycol. Fr.* **22:** 70, 1906.
Hadrotrichum piri Montem., *Riv. Patol. Veg.* **5:** 226, 1912.
Hadrotrichum populi Sacc. var. *piri* (Montem.) Ferraris, *Soc. Bot. Ital.* **1:** 875, 1914.
Hadrotrichum pirinum (Pegl.) Sacc., *Annls mycol.* **13:** 136, 1915.

Ascomata similar to *E. veneta*. Ascospores 3 septate, 10-15 × 4-6 μm. Sporodochia erumpent. Conidia ovoid to subglobose, one celled, hyaline, 4-5.5 2.5-4 μm.

On leaves and fruits of *Pyrus communis* and *Pyrus malus,* causing anthracnose of apple and pear. Asia, Europe, America.

E. rosarum Jenkins & Bitancourt, *Mycologia* **49:** 98, 1957.

Anamorph: *Sphaceloma rosarum* (Pass.) Jenkins, *J. agric. Res.* **45:** 330, 1932.

Phyllosticta rosarum Pass., *Erb. Critt. Ital. ser.* 2, No. 1092, 1881.

Ascomata subepidermal. Ascospores 3 septate, hyaline, 10-14 × 5-7 μm. Sporodochia subcuticular, erumpent. Conidia hyaline, one celled.

On leaves and twigs of *Rosa* spp. Asia, Europe and America. (Rose anthracnose).

E. veneta (Burkh.) Jenkins, *J. agric. Res.* **44:** 696, 1932.

Plectodiscella veneta Burkholder, *Phytopathology* **7:** 91, 1917.

Anamorph: *Sphaceloma necator* (Ell. & Ev.) Jenkins & Shear, *Phytopathology* **36:** 1047, 1946.

Gloeosporium necator Ell. & Ev., *J. mycol.* **3:** 129, 1887.

Spots on canes, petioles, leaves and berries. On young canes orbicular, elliptic to circular, bordered by dark narrow margin, 2-3 mm wide, on leaves mainly along the midrib and petioles but smaller; sometimes the white centre falls out causing a shot-hole effect on the leaves. Affected berries often show deformed growth. Ascomata up to 150 μm wide, when mature splitting apart in a stellate manner. Asci 25-30 μm. Ascospores hyaline or pale yellow, 3 septate, constricted at the septa, 18-21 × 6-8 μm with a gelatinous sheath.

Conidiophores aggregated in subcuticular to subepidermal acervuli in spots, short, unbranched, bearing terminal conidia. Conidia hyaline, oblong elliptical, 5-7 × 2-3 μm. In pyhtopathological literature the conidial state is often erroneously referred to as *Gloeosporium venetum* Speg. (*Michelia* **1:** 477, 1879).

On *Rubus* spp., especially on European and American red raspberries (*R. idaeus* and *R. idaeus* var. *oculentissimus*), black raspberry (*R. occidentalis*) and on loganberries, boysenberries, youngberries, etc. *(R. ursinus, R. villosus, R. vitifolius)* and the European bramble (*R. fruticosus*).

It causes the cane spot or anthracnose of raspberry resulting in dwarfing of canes and often die-back from the tip, and is widespread, occurring in cooler temperate areas of N. America, W. Europe and Australia (Sivanesan & Critchett, 1976).

Pleosporales

Pseudothecia immersed singly in the host or in a stroma, or superficial in a hyphal subiculum or erumpent stroma, glabrous or setose, unilocular, rarely multilocular, usually with a papillate apical ostiole. Asci interspersed with pseudoparaphyses.

Key to families of Pleosporales

Pseudothecia initially at least, often bright-coloured, usually soft and fleshy.... ..... Tubeufiaceae

Pseudothecia brown, dark brown to black, not soft and fleshy..... 1

1. Pseudoparaphyses trabeculate..... 2

   Pseudoparaphyses cellular..... 3

   Pseudothecia applanate to distinctly depressed, often clypeate..... ..... Didymosphaeriaceae

   Pseudothecia globose depressed, conical, peridium of equal thickness..... ..... Melanommataceae

3. Chiefly on wood, bark and dead herbaceous stems, saprophytes or parasites, ascospores one or more septate, or dictyoseptate..... Pleosporaceae

   Leaf parasites, rarely on stems, sometimes maturing on dead stems, ascospores one septate, often unequally..... Venturiaceae

Didymosphaeriaceae Munk

Pseudothecia applanate to distinctly depressed. Peridium usually thickened over the apex, clypeate. Ascospores hyaline to brown, transversely one or more septate. Pseudoparaphyses trabeculate.

Key to genera of Didymosphaeriaceae with anamorphs

Pseudothecia with short dark brown setae in the ostiolar papillae, ascospores hyaline to very pale brown, one or more septate..... *Keissleriella*

Pseudothecia without setae, ascospores brown to dark brown, one septate..... ..... *Didymosphaeria*

DIDYMOSPHAERIA Fuckel, *Symb. mycol.*: 140, 1870.

Phaeodothis H. & P. Sydow, *Annls mycol.* **2:** 166, 1904.
Didymascina Höhnel, *Annls mycol.* **3:** 331, 1905.

Cryptodidymosphaeria (Rehm) Höhnel, *Sber. Akad. Wiss. Wien* **126:** 360, 1917.
Massariellopsis Curzi, *Atti Ist. Bot. Univ. Pavia* **3:** 162, 1927.
(fide von Arx & Müller, 1975).

Type sp.: *D. futilis* (Berk. & Br.) Rehm, *Hedwigia* **18:** 167, 1879.

Anamorphs: *Dendrophoma* Sacc. (*Phoma*); *Ascochyta* Lib. and *Periconia* Tode: Fr.

Approximately 300 species are described in or transferred to *Didymosphaeria,* some at least belong in different genera. The genus is heterogenous and together with its synonyms needs a complete revisionary study. (Scheinpflug, 1958; Müller & von Arx, 1962).

Pseudothecia scattered or often united in groups, immersed, subepidermal, dark coloured, subglobose or slightly flattened, sometimes associated with a slight development of clypeus around the short erumpent ostiole and with hyphae often blackening the substrate. The pseudothecial wall of textura prismatica is composed of many layers of very small brown to lightly pigmented indistinct cells on the outer layers which are more strongly pigmented and thick-walled around the clypeus, with somewhat larger and narrow cells lining the locule. Asci numerous, 1-8 spored, subsessile to short-stalked, thickened above, arising from a basal cushion of hyaline hymenium. Ascospores obliquely uniseriate or biseriate, one septate, smooth or minutely verruculose, not or constricted at the septum, olivaceous brown to brown. Pseudoparaphyses numerous, branched, hyaline and filiform, trabeculate.

Key to Didymosphaeria species with anamorphs

Ascospores not more than 16 μm long..... 1

Ascospores more than 16 μm long..... 2

1. Ascospores 8-14 × 3.5-6 μm, anamorph *Dendrophoma,* conidia 3-6 × 1-2 μm..... *D. futilis*

   Ascospores 10-16 × 3.5-5 μm, anamorph *Ascochyta,* conidia 8-14 × 2.5-4 μm..... *D. loliina*

   Ascospores 13-16 × 5-7.5 μm, anamorph *Ascochyta,* conidia 4-17 × 2.5-5.5 μm..... *D. arachidicola*

2. Ascospores 18-25 × 11-15 μm, anamorph *Dendrophoma,* conidia 4-7 × 1-2 μm..... *D. spartii*

   Ascospores 20-30 × 8-9 μm, anamorph *Periconia*..... *D. igniaria*

D. arachdicola (Chochrjakov) Alcorn, Punith. & McCarthy, *Trans. Br. mycol. Soc.* **66:** 354, 1976 (Fig. 192).

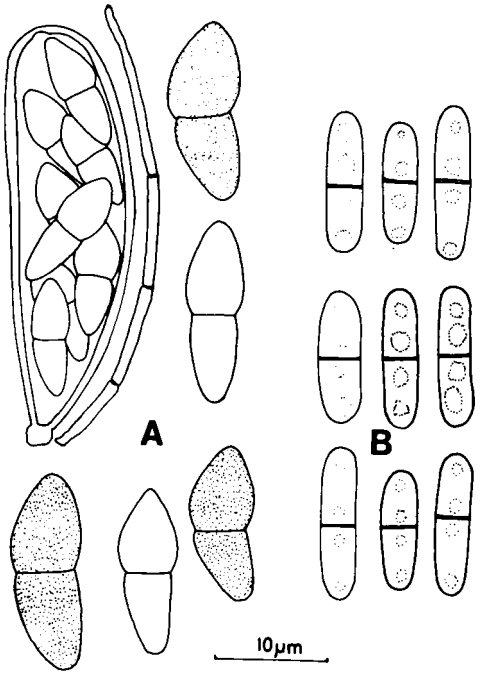


Fig. 192. *Didymosphaeria arachidicola.* A, ascus and ascospores; B, conidia.

Mycosphaerella arachidicola Chochrjakov, *Bolenzni i vrediteli maslichnykh kul'tur* **1:** 29, 1934.
Mycosphaerella argentinensis Frezzi, *Rev. Invest. Agrop. Ser.* 5, **6:** 149, 1969.
Didymella arachidicola (Cochr.) Tomilin, *Key to Fungi of the genus Mycosphaerella Johans.:* 285, 1979.

Anamorph: *Ascochyta adzamethica* Schoschiaschvili, *Izvestiya Gruzinskoĭ Optnoĭ Stantsii Zashchitŭ Rastenii Ser. A., Fitopat, No.* **2,** 272, 1940.

?Ascochyta arachidis Woronichin, *Not.syst.Inst.Crypt.Horti.Bot.Reip. Ross.* **3:** 31, 1924.
Phoma arachidicola Marasas, Pauer & Boerema, *Phytophylactia* **6:** 20, 1974.

Pseudothecia up to 140 μm broad. Asci cylindrical to cylindric-clavate, stalked, 35-58 × 11-15 μm. Ascospores hyaline to brown, smooth, ellipsoidal clavate, constricted at the septum, upper cell broader and more sharply tapered than the lower, apex bluntly conic, lower cell tapering gradually to an obtuse end, 13-16 × 5-7.5 μm.

Pycnidia pale to dark brown, globose, ostiolate, solitary up to 220 μm broad. Conidiogenous cells hyaline, phialidic, globose, ovoid or oblong, 5-7 × 4-5 μm. Conidia hyaline, 0-1 septate, oval or cylindrical with rounded ends or base flattened, 4-17 × 2.5-5.5 μm. Chlamydospores often formed in the agar media. The genetic connection between the two states has been established by Alcorn *et al.* (1976).

On *Arachis hypogaea*. Argentina, Australia, Mauritius, South Africa and USSR.

D. futilis (Berk. & Br.) Rehm, *Hedwigia* **18:** 167, 1879.

Sphaeria futilis Berk. & Br., *Ann. Mag. Nat. Hist.* Ser. 2, **9:** 317, 1852.

(For other synonyms refer to Müller & von Arx, 1962).

Anamorphs: *Dendrophoma* sp. and a *Fusicladiella*-like form produced in culture.

Pseudothecia clypeate, up to 500 μm broad. Asci 1-8 (mostly 8) spored, 60-90 × 6-8 μm. Ascospores obliquely uniseriate in the ascus, ellipsoidal, somewhat constricted at the septum, olivaceous brown, thick-walled, smooth 8-14 × 3.5-6 μm.

Dendrophoma pycnidia were obtained by Müller & Corbaz (1956) from ascospore isolations. Conidiophores 15-30 × 1-2 μm bearing one celled conidia lining the inside of the locule. Conidia elongate-ellipsoid, hyaline, 3-6 × 1-2 μm.

On stems of various dicotyledons. Cosmopolitan.

Brefeld (1891) also obtained 2 celled, *Fusicladiella*-like conidia which measured 10-20 μm in culture but this is rather doubtful and has not been reproduced since.

D. igniaria C. Booth, *Trans. Br. mycol. Soc.* **51:** 803, 1968 (Fig. 193).

Anamorph: *Periconia igniaria* Mason & M.B. Ellis, *Mycol. Pap.* **56:** 104, 1953.

Pseudothecia up to 300 μm broad. Asci cylindrical, 150-165 × 8-12 μm. Ascospores initially hyaline becoming pale brown at maturity, smooth to verruculose, constricted at the septum, 20-30 × 8-9 μm. Mycelium embedded, hyaline or pale to dark brown, smooth, verruculose or closely warted, septate, branched, swollen in some places. Stroma composed of dark brown, ovoid, irregular or spherical cells,

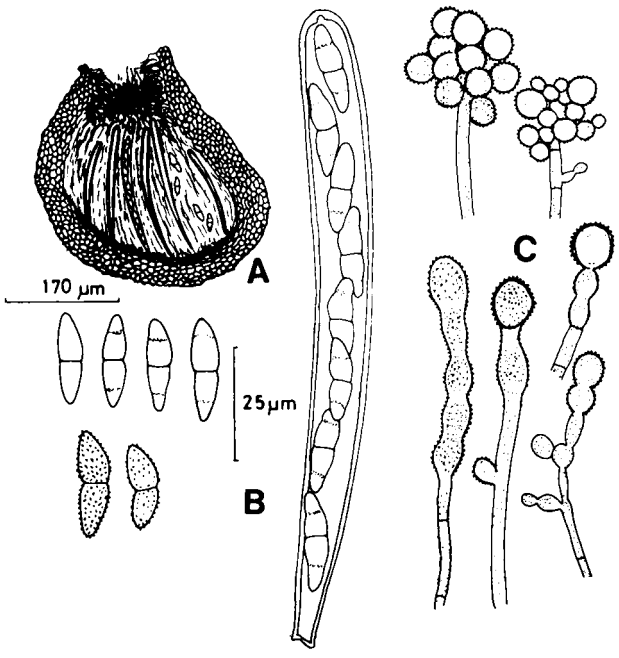


Fig. 193. *Didymosphaeria igniaria* (type). A, v.s. of pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

superficial or partly immersed. Conidiophores macronematous, single or in small groups, straight or flexuous, swollen at the base, septate, up to 550 µm long, 9-13 µm thick, bearing near the apex a number of brown ovoid cells from which arise several short, thick, rough-walled branches which themselves may branch repeatedly. Conidiogenous cells monoblastic or polyblastic, determinate, ellipsoidal to subglobose. Conidial heads dark to chocolate brown, spherical when young but becoming irregular in outline at maturity, 70-300 µm diam., in culture 110-160 µm diam. Conidia borne in chains on narrow branches, spherical, brown, 7-10 µm diam., with spines approximately 1 µm long. The species is homothallic and can be produced either by culturing single ascospores or conidial isolates on PDA with pieces of wheat straw under ultra-violet source (Booth, 1968).

On *Ammophila, Artemesia, Borassus, Cajanus, Carex, Citrus, Dactylis, Lycopersicon, Phalaris, Phragmites, Saccharum, Spartina* and *Zea,* often following burning and also isolated from air, soil and copper sulphate solution.

Australia, Europe, Ghana, India, Jamaica, U.S.A, Zambia.

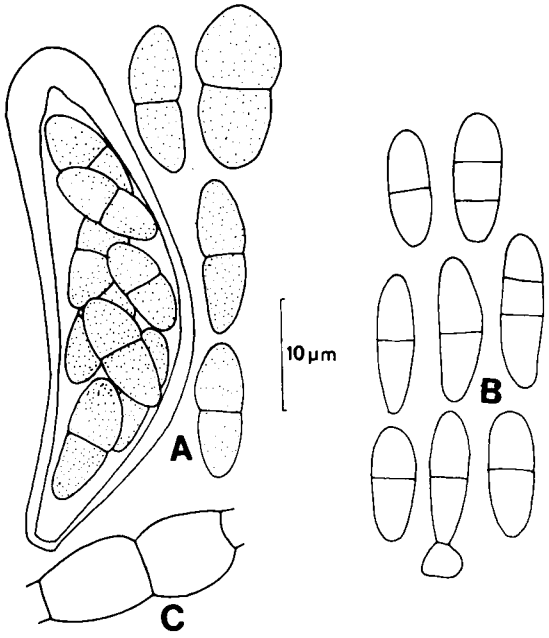


Fig. 194. *Didymosphaeria loliina* (type). A. ascus and ascospores; B, conidia; C, chlamydospore.

D. loliina Punith., *Mycol. Pap.* **142:** 175, 1979 (Fig. 194).

Anamorph: *Ascochyta* sp.

Pseudothecia with short necks, up to 220 µm broad. Asci subclavate or broadly obovoid, subsessile, 40-70 × 10-15 µm. Ascospores hyaline later becoming brown, slightly biconic or broadly ellipsoidal, slightly constricted at the septum, 10-16 × 3.5-5 µm.

Pycnidia solitary or aggregated, up to 200 µm broad, ostiolate. Conidiogenous cells hyaline, doliiform, phialidic, formed from the cells lining the locule. Conidia hyaline, shortly cylindrical, oblong or ellipsoidal, septate in the middle or rarely 2 septate, guttulate 8-14 × 2.5-4 µm, with rounded ends.

Isolated from *Lolium* seeds. West Germany.

Punithalingam (1979) has proved the genetic connection between the ascusand pycnidial states of this species.

D. spartii (Castagne) Fabre, *Ann. Sci. Nat.* Ser. 6, **9:** 83, 1878.

Sphaeria spartii Castagne, *Cat. Pl. Marseille* **8:** 169, 1845.

Anamorph: *Dendrophoma* sp.

Pseudothecia clypeate, up to 300 μm broad. Asci broadly cylindrical, 110-140 × 14-20 μm. Ascospores broadly ellipsoidal, golden brown, 18-25 × 11-15 μm, strongly constricted at the septum, finely sculptured, surrounded by a mucilaginous sheath.
Pycnidia of *Dendrophoma* type. Conidia 4-7 × 1-2 μm.

On *Calicotome, Sarothamnus* and *Spartium* spp. Europe.

Müller & Corbaz (1956) obtained the *Dendrophoma* pycnidial state from ascospore isolations.

KEISSLERIELLA Höhnel, *Sber. Akad. Wiss. Wien* **128:** 582, 1919.

Zopfinula Kirschst., *Annls mycol.* **37:** 98, 1939.
Coenosphaeria Munk, *Dansk Bot. Arkiv* **15:** 133, 1953.
Trichometasphaeria Munk, *Dansk. Bot. Arkiv* **15:** 135, 1953.

Type sp.: *K. aesculi* (Höhnel) Höhnel, *Sber. Akad. Wiss. Wien* **128:** 582, 1919 (= *Didymosphaeria cladophila* Niessl, 1875).

Anamorphs: *Dendrophoma* Sacc. and *Ascochyta* Lib.

About 20 species, saprophytic (Bose, 1961; Dennis, 1978; Müller & von Arx, 1962).

Pseudothecia subepidermal, black, minute, globose to subglobose with a small ostiolar papilla bearing short dark brown setae, scattered, sometimes with a slightly developed clypeus, solitary or in groups, sometimes on or within empty fruit bodies of other pyrenomycetes. The wall is composed of thick-walled, dark brown cells on the outer layers and thin-walled, pale brown to hyaline cells on the inner layers. Asci cylindrical, cylindric clavate or clavate, thickened at the apex, mostly 8 spored, occasionally 4 spored. Ascospores hyaline, 1-3 or more septate, fusiform, elliptic-fusiform or ovoid, straight or curved, often surrounded by a mucilaginous sheath. Pseudoparaphyses filiform, branched, hyaline, trabeculate.

Key to Keissleriella species with anamorphs

Ascospores fusiform, 3 septate, 17-21 × 3.5-4 μm, anamorph *Dendrophoma,* conidia 3-4.5 × 1-1.5 μm..... *K. alpina*

Ascospores elliptic-fusoid, 3 septate, 17-25 × 4.5-6 μm, anamorph *Ascochyta,* conidia 15-18 × 4-4.5 μm..... *K. gallica*

Ascospores 1 (3) septate, ellipsoid-biconical, 10-16 × 4-6 μm, anamorph *Dendrophoma,* conidia 5-7 × 2-2.5 μm..... *K. cladophila*

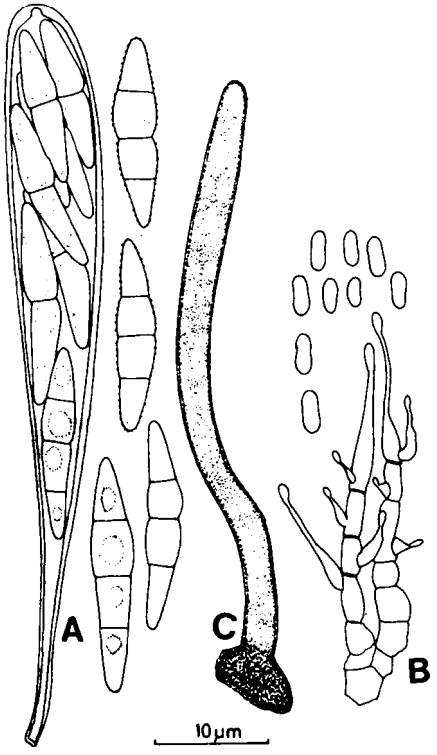


Fig. 195. *Keissleriella alpina* (type). A, ascus and ascospores; B, conidiophores and conidia; C, ostiolar seta.

K. alpina Bose, *Phytopath. Z.* **41:** 186, 1961 (Fig. 195).

Anamorph: *Dendrophoma* sp. (Bose, 1961).

Pseudothecia up to 250 µm broad, solitary or in groups on or inside empty stroma of other Pyrenomycetes. Asci 55-85 × 7-9 µm. Ascospores 3 septate, constricted in the median septum, 17-21 × 3.5-4 µm, fusoid, guttulate with tapering acute ends, smooth to lightly verruculose.

In culture pycnidia were formed after six months at room temperature. Pycnidia up to 200 µm broad, with long simple or branched beak or papillate apex, ostiolate. Conidiogenous cells branched, cylindrical, up to 60 µm long and 2 µm thick. Conidia hyaline, oblong or subcylindrical, 3-4.5 × 1-1.5 µm formed singly.

On pyrenomycetes on twigs of *Acer pseudoplatanus*. Switzerland.

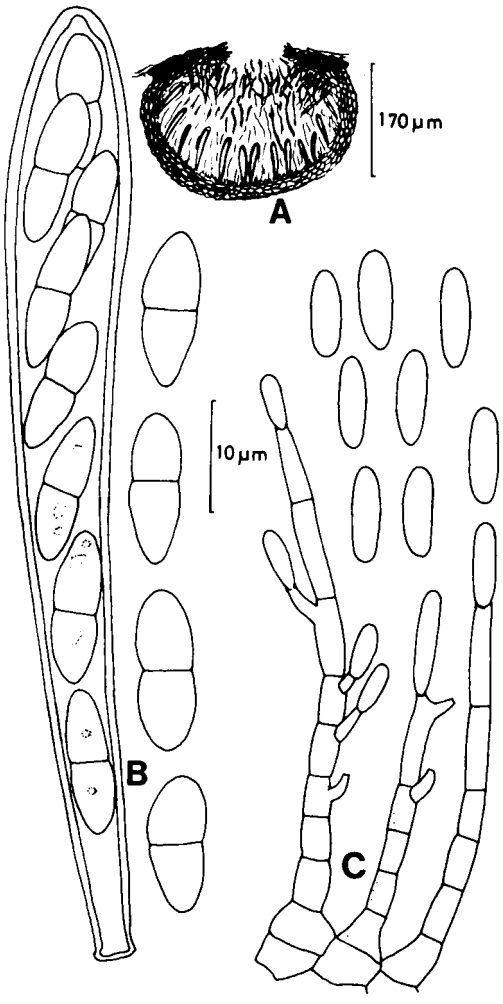


Fig. 196. *Keissleriella cladophila.* A, v.s. pseudothecium; b, ascus and ascospores; C, conidiophores and conidia.

K. cladophila (Niessl) Corbaz, *Phytopath. Z.* **28:** 410, 1956 (Fig. 196).

Didymosphaeria cladophila Niessl, *Oest. Bot. Zeit.* **25:** 199, 1875.
Didymella cladophila (Niessl) Sacc., *Syll. Fung.* **1:** 545, 1882.
Didymella sambucina Rehm, *Annls mycol.* **5:** 538, 1907.
Otthiella aesculi Höhnel, *Sber. Akad. Wiss. Wien* **126:** 377, 1917.
Keissleriella sambuci (Rehm) Höhnel, *Sber. Akad. Wiss. Wien* **128:** 582, 1919.
Zopfinula sambucina Kirschst., *Annls mycol.* **37:** 98, 1939.

Coenosphaeria diaporthoides Munk, *Dansk Bot. Ark.* **15:** 133, 1953.
Amphididymella ahmadii E. Müller & Corbaz, *Sydowia* **9:** 256, 1955.
Trichometasphaeria cladophila (Niessl) Holm, *Symb. Bot. Upsal.* **14:** 140, 1957.

Anamorph: *Dendrophoma* sp. (Bose, 1961).

Pseudothecia up to 500 μm broad. Asci 70-125 × 9-12 μm. Ascospores one septate, constricted at the septum, may become 3 septate when mature, ellipsoid-biconical, 10-16 × 4-6 μm.

Pycnidia formed in culture after about two months. On host up to 150 μm broad, globose, ostiolate. Conidiogenous cells branched, 10-40 × 2-2.5 μm. Conidia hyaline, one celled, oblong, 5-7 × 2-2.5 μm.

On *Aesculus, Berberis, Genista, Kerria, Salix, Sarothamnus.* Europe, Pakistan, U.S.A.

K. gallica (E. Müller) Bose, *Phytopath. Z.* **41:** 187, 1961 (Fig. 197).

Trichometasphaeria gallica E. Müller, *J. Madras Univ.* **27:** 29, 1957.

Anamorph: *Ascochyta* sp.

Pseudothecia up to 250 μm broad, immersed, clypeate at the epidermal region. Asci 80-100 × 10-12 μm. Ascospores elliptic-fusoid, 17-25 × 4.5-6 μm, 3 septate.

Pycnidia globose, up to 220 μm broad, ostiolate, thick-walled near the apex, composed of thick-walled brown cells. Conidiogenous cells obpyriform, short, hyaline, phialidic, formed from the cells lining the pycnidial cavity. Conidia hyaline, fusiform, 0-1 septate, 15-18 × 4-4.5 μm.

Both pseudothecia and pycnidia are parasitic in living twigs of *Spartium junceum* and *Rumex acetosa,* Europe. Bose (1961) obtained the pycnidial state in culture from single ascospore isolations.

Melanommataceae Winter

Pseudothecia globose or depressed. Peridium of equal thickness. Ascospores broadly ellipsoidal, sometimes narrowly ellipsoidal, hyaline to brown, usually transversely multiseptate. Pseudoparaphyses trabeculate.

Anamorphs: *Aposphaeria* Höhnel, *Cyclothyrium* Petrak and *Pseudospiropes* M.B. Ellis.

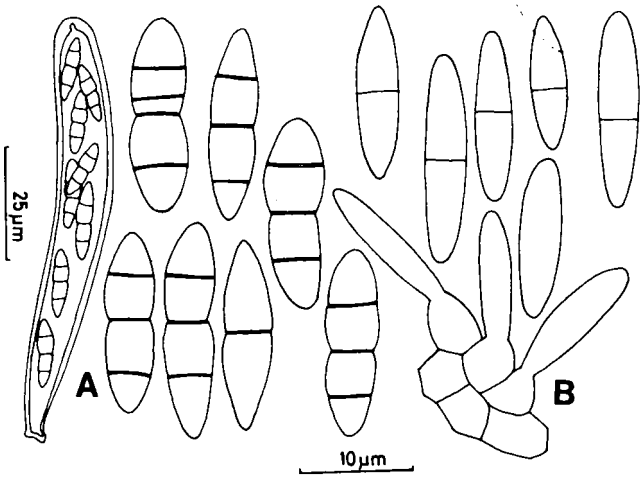


Fig. 197. *Keissleriella gallica.* A, ascus and ascospores; B, conidiophores and conidia.

Key to genera with anamorphs

Pseudothecia gregarious, superficial at least at maturity, with a thin mycelial crust..... *Melanomma*

Pseudothecia gregarious in a stroma, enveloped by a hyphal web... *Thyridaria*

MELANOMMA Nits. ex Fuckel, *Symb. mycol.* :159, 1870.

Type Sp.: *M. pulvis-pyrius* (Pers.) Fuckel, *Symb. mycol.*: 160, 1870.

Anamorphs: *Aposphaeria* Sacc. and *Pseudospiropes* M.B. Ellis.

Pseudothecia mostly gregarious, rarely scattered, initially immersed but finally superficial, sometimes on a well-developed subiculum, black, corticolous, globose to depressed conical or flask-shaped, smooth or hairy, with a rounded or beaked ostiolar apex. Peridium more or less uniformly thickened of textura angularis, composed of dark brown, more or less scleroplectenchymatous, thick-walled cells on the outside and less dark brown and less thick-walled cells toward the inside. Asci numerous cylindric or cylindric-clavate, 8 spored, arising from a basal cushion of hymenial tissue. Ascospores uniseriate or biseriate in the ascus, hyaline to olivaceous brown when mature, broadly ellipsoidal, three septate. Pseudoparaphyses numerous, narrowly filiform, simple

or branched, apparently non septate, anastomosing, embedded in a gelatinous matrix. Lignicolous species often colouring the substrate.

Aposphaeria pycnidia similar in shape to pseudothecia often found in close association with each other, immersed to superficial, ostiolate. The wall is composed of pseudoparenchymatous cells with the cells on the outer layers dark brown and thick-walled and in the inner layer thin-walled and hyaline. Conidiogenous cells phialidic, enteroblastic, formed from the cells lining the pycnidial cavity, simple, flask-shaped. Conidia hyaline, ellipsoidal, oval, subglobose or oblong, biguttulate, rounded at the ends, formed at the apex of the phialide, extruded in a cream coloured mass through the ostiole.

Holm (1957) has included a number of species referred to *Leptosphaeria* in *Melanomma*. Chesters (1938) has made an extensive study of *M. pulvis-pyrius* and *M. fuscidulum* both in nature and in culture and obtained pycnidia from cultures established from single ascospores and conidia.

Key to Melanomma species with anamorphs

Ascospores 18-30 × 5-7.5 μm, anamorph *Pseudospiropes*... *M. subdispersum*

Ascospores up to 20 μm long, anamorph *Aposphaeria*..... 1

1. Ascospores 12-20 × 2-6 μm, uniseriate, conidia 2-3.5 × 1-5-2.5 μm..... ..... *M. pulvis-pyrius*

   Ascospores 11-16 × 3-4 μm, biseriate, conidia 3.5-5 × 2.5-4 μm..... ..... *M. fuscidulum*

M. fuscidulum Sacc., *Michelia* **1:** 450, 1878 (Fig. 198).

Anamorph: *Aposphaeria fuscidula* (Sacc.) Sacc., *Syll. Fung.* **3:** 173, 1884.

Phoma fuscidula Sacc., *Michelia* **2:** 271, 1881.

Pseudothecia scattered, semi-immersed, erumpent or densley crowded and almost superficial on a mycelial subiculum, ostiolate, upto 0.5 mm broad. Asci cylindric-clavate, 50-105 × 6-10 μm. Ascospores biseriate in the ascus, 3 septate, olivaceous brown, 11-16 × 3-4 μm. Pycnidia small, scattered among pseudothecia, covered by mycelia. Conidia hyaline, oblong, oval or subglobose, sometimes faintly yellowish, guttulate, 3.5-5 × 2.5-4 μm. On *Acer, Bambusa, Fagus, Fraxinus, Hedera, Lonicera, Quercus, Rhamnus, Salix, Sambucus, Ulex, Ulmus.* Great Britain.

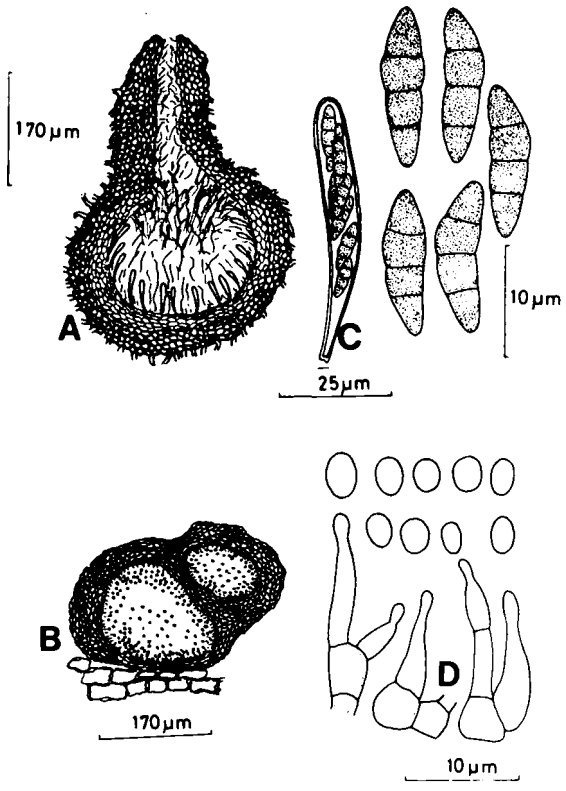


Fig. 198. *Melanomma fuscidulum.* A, v.s. pseudothecium; B, v.s. of pycnidium; C, ascus and ascospores; D, conidiophores and conidia.

M. pulvis-pyrius (Pers.) Fuckel, *Symb. mycol. :* 160, 1870 (Fig. 199).

Sphaeria pulvis-pyrius Pers., *Syn. Meth. Fung.* : 86, 1801.
Sphaeria myriocarpa Fr., *Syst. mycol.* **2:** 459, 1823.
Sphaeria conglobata Fr., *Syst. mycol.* **2:** 414, 1823.
Sphaeria subsparsa Fuckel, *Symb. mycol.:* 160, 1870.

Anamorph: *Aposphaeria agminalis* (Sacc.) Sacc., *Syll. Fung.* **3:** 171, 1884.

Phoma agminalis Sacc., *Michelia* **2:** 379, 1881.

Pseudothecia gregarious, immersed becoming superficial, often seated on a thin dark mycelial subiculum, black, dull or shining, up to 0.5 mm

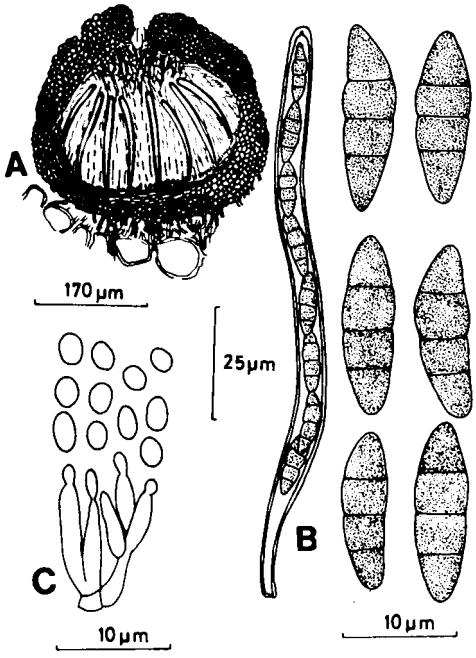


Fig. 199. *Melanomma pulvis-pyrius* (type). A, v.s. pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

broad. Asci 80-110 × 6-9 µm. Ascospores uniseriate but slightly overlapping, elliptic-fusiform, straight or slightly curved, 12-20 × 2-6 µm, 3 septate, slightly constricted at the septa, the second cell from the top slightly wider than the others, pale brown to brown.

Pycnidia carbonaceous, scattered or crowded, immersed or superficial, ostiolate, pseudoparenchymatous. Conidia ellipsoid or somewhat oblong, rounded at the ends, guttulate, 2-3.5 × 1.5-2.5 µm.

On a wide variety of hosts. America, Europe.

Chesters (1938) suggested *A. agminalis* as the pycnidial state.

M. subdispersum (P. Karsten) Berl. & Vogl., *Syll. Fung. Addit.* **1-4:** 148, 1886 (Fig. 200).

Sphaeria subdispersum P. Karsten, *Meddel. Soc. Fl. F. Fennica* **11:** 146, 1884.

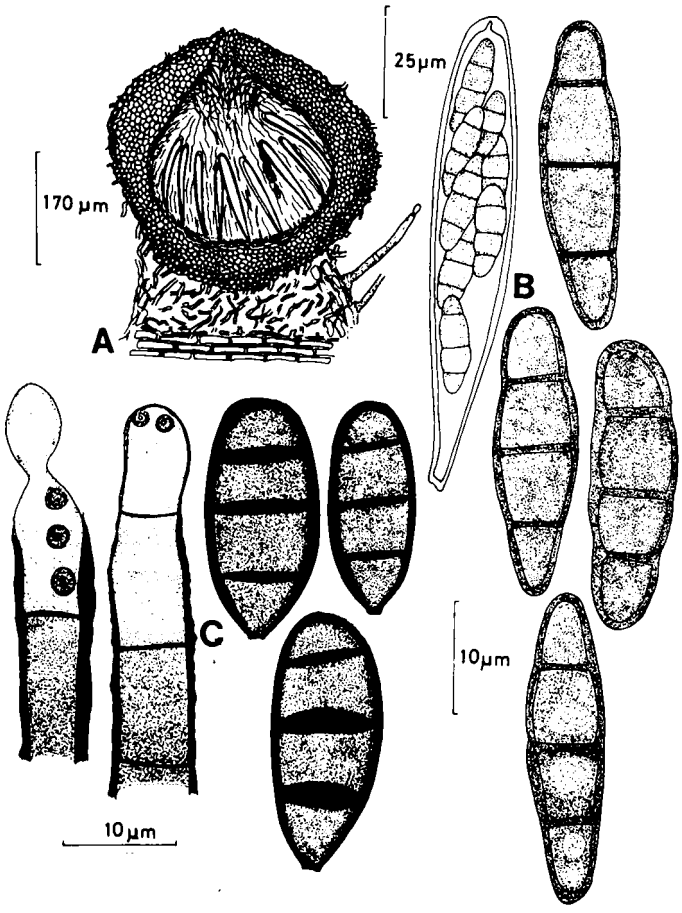


Fig. 200. *Melanomma subdispersum.* A, v.s. of pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

Anamorph: *Pseudospiropes longipilus* (Corda) Hol.-Jech., *Koninkl. Nederl. Akad. Wetens.* **76:** 298, 1973.

Helminthosporium longipilum Corda, *Icon. Fung.* **1:** 14, 1837 (as '*Helmisporium*')
Helmisporium arbusculoides Peck, *Rep. N. Y. St. Mus.* **34:** 51, 1883.
Helminthosporium longipilum Corda var. *effusum* P. Karsten, *Meddel. Soc. Fl. F. Fennica* **11:** 146, 1884.
Brachysporium longipilum (Corda) Sacc., *Syll. Fung.* **4:** 425, 1886.
Brachysporium longipilum (Corda) Sacc. var. *effusum* (P. Karsten) Sacc., *Syll. Fung.* **4:** 426, 1886.

Pseudothecia basally immersed, up to 400 μm broad. Asci 120-130 × 16-20 μm. Ascospores oblong fusoid, straight, slightly constricted at the median septum, yellow brown, 18-30 × 5-7.5 μm.

Conidial colonies effuse, black, hairy. Conidiophores straight to flexuous, septate, dark blackish brown, paler near the apex which bears several conidial scars. Conidiogenous cells polyblastic, integrated, terminal, sympodial, cylindrical, cicatrized. Conidia ellipsoidal to cylindrical, rounded at the apex, usually with a somewhat protuberant scar at the base, 0-5 mostly 3 septate, pale to dark brown, smooth, 16-26 × 6-11 μm. (Ellis, 1976).

On periderm of *Betula,* sometimes on *Sorbus.* Canada, Europe.

The teleomorph and the anamorph are closely associated and the connection has yet to be proved by cultural studies.

THYRIDARIA Sacc., *Grevillea* **4:** 21, 1875.

Type sp.: *T. incrustans* Sacc., *Grevillea* **4:** 21, 1875.

Pseudothecia grouped in isolated pustules, rarely single, immersed in a loose mycelial stroma composed of a more or less uniformly thickened wall of pseudoparenchymatic cells. Asci cylindrical to slightly clavate, stalked, 8 spored. Ascospores brown, uni- or biseriate, commonly transversely 3 septate, slightly constricted at the septum.

T. rubro-notata is known to have a *Cyclothyrium* pycnidial anamorph.

T. rubro-notata (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 141, 1883 (Fig. 201)

Melogramma rubro-notata Berk. & Br., *Ann. Mag. Nat. Hist. ser.* 3, **3:** 375, 1859.
Massaria lateritia Tul. & Tul., *Sel. Fung. Carp.* **2:** 244, 1863.
Thyridaria delognensis Speg. & Roum. in Roum., *Rev. Mycol.* **2:** 21, 1880.
Melogramma delognensis (Speg. & Roum.) Cooke, *Grevillea* **13:** 109, 1885.
Kalmusia delognensis (Speg. & Roum.) Winter in Rabenh., *Krypt.-Fl.* **1:** 764, 1887.

Anamorph: *Cyclothyrium juglandis* (Schum.) B. Sutton, *Mycol. Pap.* **141:** 56, 1977.

Naemospora juglandis Schum., *Enum. Pl. Saell.* **2:** 178, 1803.
Cytospora juglandis (Schum.) *Krypt.Fl.:* 148, 1844.
Cytoplea juglandis (Schum.) Petrak in Petrak & H. Sydow, *Beih. Rep. spec. nov. regni veg.* **42:** 449, 1927.

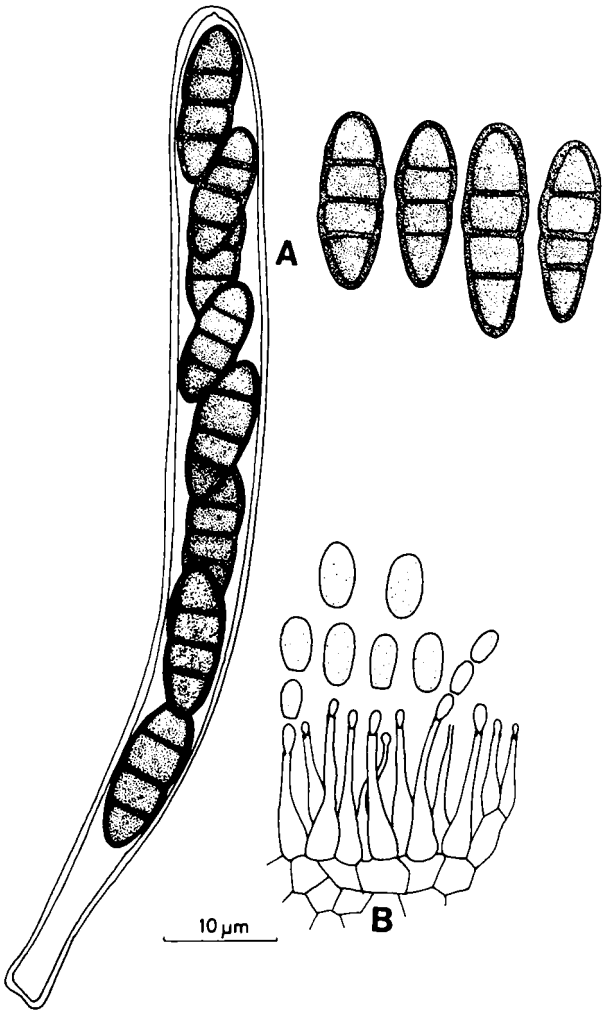


Fig. 201. *Thyridaria rubro-notata.* A, ascus and ascospores; B, conidiophores and conidia.

Pseudothecia in a stroma of compact interwoven brown hyphae. Stroma immersed in the bark. Pseudothecia globose with short stout necks and erumpent ostiole, surrounded by more or less conspicuous reddish mealy hyphae on the surface of the stroma. Asci cylindric-clavate, 90-128 × 7-10 µm. Ascospores monostichous in the ascus, slightly clavate to elliptical, slightly constricted at the septa, dark brown, 14-20 × 5-6 µm.

Pycnidia dispersed among pseudothecia, stromatic, multilocular, convoluted, dehiscing by rupture of the overlying host tissue, with a wall composed of thin walled brown cells, up to 700 μm diam. Conidiophores hyaline, simple or branched at the base, rarely branched above, smooth, hyaline, 12-16 × 2.5-5 μm. Conidiogenous cells enteroblastic, phialidic, indeterminate, often percurrent, cylindrical, hyaline, integrated or discrete, with a minute channel and collarette and distinct periclinal thickening. Conidia pale brown, globose or ovate cylindrical, at first hyaline, guttulate, 5-8 × 2.5-4 μm, discharged in a sticky glistening mass.
On dead branches of *Acer, Gymnosporia, Hedera, Juglans, Rosa, Salix, Ulmus.* India, Great Britain.

Chesters (1938) has obtained identical cultures bearing entirely similar pycnidia from single ascospore and conidial isolates of this species.

Pleosporaceae Winter

Pseudothecia medium to large, superficial, erumpent, immersed in or on a stroma. Ascospores one to many septate or dictyoseptate. Pseudoparaphyses cellular, filiform, septate, branched.

Parasites or saprophytes on wood, dead herbaceous stems and rarely on leaves.

Key to Genera of Pleosporaceae

Ascospores filiform..... 1

Ascospores not filiform..... 3

1. Ascospores parallel in the ascus..... 2

   Ascospores coiled in a helix in the ascus..... *Cochliobolus*

2. Pseudothecia more or less erumpent with distinct beaks..... *Ophiobolus*

   Pseudothecia immersed, finally erumpent without beaks..... *Rhytidiella*

3. Ascospores transversely septate..... 4

   Ascospores dictyoseptate..... 14

4. Ascospores one septate..... 5

   Ascospores one or more septate..... 8

5. Ascospores hyaline..... *Didymella*

   Ascospores brown..... 6

6. Pseudothecia flattened hemispherical, partly immersed in the host, ascospores thin-walled..... *Microthelia*

   Pseudothecia globose, entirely superficial, solitary, or aggregated on a crustose stroma or on a subiculum, ascospores thick or thin-walled, smooth to verrucose..... 7

7. Pseudothecia solitary or aggregated on a crustose stroma, ascospores smooth to verrucose..... *Otthia*

   Pseudothecia on a subiculum, ascospores smooth..... *Zeuctomorpha*

8. Ascospores hyaline or rarely subhyaline..... 9

   Ascospores hyaline at first becoming brown or brown..... 10

9. Pseudothecia immersed in woody stems, glabrous, ascospores large, hyaline, one or more septate with gelatinous sheath or appendage..... *Massarina*

   Pseudothecia setose, superficial, immersed to erumpent, ascospores with gelatinous sheath..... *Setosphaeria*

   Pseudothecia hyperparasitic on other fungi, glabrous, ascospores with or without gelatinous sheath..... *Eudarluca*

10. Ascospores punctate or verrucose..... 11

    Ascospores smooth..... 12

11. Ascospores large, thick-walled, with gelatinous sheath.... *Splanchnonema*

    Ascospores small, thin-walled, with or without gelatinous sheath..... *Paraphaeosphaeria*

12. Pseudothecia on a subiculum of brown hyphae..... *Herpotrichia*

    Pseudothecia immersed, solitary or erumpent in clusters..... 13

13. Pseudothecia erumpent in clusters, often united in a stromatic base..... *Asteromassaria*

    Pseudothecia solitary, small..... *Leptosphaeria*

14. Pseudothecia without a stroma..... 15

    Pseudothecia on a basal stroma..... 17

15. Pseudothecia immersed in bark, ascospores with distinct mucilaginous sheath..... *Pleomassaria*

    Pseudothecia on dead herbaceous stems, partially or fully erumpent, with or without thin mucilaginous sheath..... 16

16. Pseudothecia glabrous or hairy, ascospores large, commonly dark brown... *Pleospora*

    Pseudothecia often with dark brown bristles on their upper surface, ascospores generally small, less than 50 μm long, hyaline to pale brown..... *Pyrenophora*

17. Pseudothecial wall scleroplectenchymatic..... *Cucurbidothis*

Pseudothecial wall pseudoparenchymatic..... 18

18. Basal stroma pseudoparenchymtic..... *Cucurbitaria*

Basal stroma prosenchymatic..... *Gemmamyces*

ASTEROMASSARIA Höhnel, *Sber. Akad. Wiss. Wien* **126:** 368, 1917.

Type sp.: *A. macrospora* (Desm.) Höhnel, *Sber. Akad. Wiss. Wien* **126:** 368, 1917.

Six species known (Barr, 1982). Only *A. macrospora* is known to have a *Scolicosporium* anamorph.

A. macrospora (Desm.) Höhnel, *Sber. Akad. Wiss. Wien* **126:** 368, 1917 (Fig. 202).

Sphaeria macrospora Desm., *Ann. Sci. Nat. Bot. Ser.* 3, **10:** 350, 1848.
Melanconis macrospora (Desm.) L.R.Tul., *Comptes Rendus* **42:** 703, 1856.
Cucurbitaria macrospora (Desm.) Ces. & de Not., *Comm.Soc.Critt.Ital. fasc.* **IV:** 215, 1863.
Massaria macrospora (Desm.) Sacc., *Syll. Fung.* **2:** 10, 1883.
Gibberulina macrospora (Desm.) Kuntze, *Rev.Gen.Pl.* **3:** 481, 1898.
Splanchonema macrospora (Desm.) Kuntze, *Rev.Gen.Pl.* **3:** 531, 1898.
Gibberidea macrospora (Desm.) Schroeter in Cohn, *Krypt.-Fl. Schles.* **3:** 315, 1908.

Anamorph: *Scolicosporium macrosporium* (Berk.) B. Sutton, *Mycol. Pap.* **141:** 185, 1977.

Coryneum macrosporium Berk., *Hooker's Eng. Fl.* **5:** 355, 1836.
Sporidesmium vermiforme Reiss in Fres., *Beitr. Mykol. fasc.* **II:** 51, 1852.
Scolicosporium fagi Lib. in Sacc., *Michelia* **2:** 355, 1881.

Pseudothecia in small clusters, often confluent, immersed, on surface as large pustules with ruptured periderm, subglobose, 0.5-0.75 μm broad, smooth, black, each with a minute apical papillate ostiole. The wall is composed of dark brown to black, globose to angular cells which are more thick-walled and pigmented on the outside. Asci cylindric-clavate to clavate, short-stalked, 8 spored, 200-250 × 40-45 μm. Ascospores monostichous below and distichous above, at first hyaline and one septate, finally brown and 3 septate, fusoid ellipsoid, surrounded by a thin mucilaginous sheath when young, thick-walled, 40-55 × 14-20 μm. Pseudoparaphyses filiform, hyaline and branched.

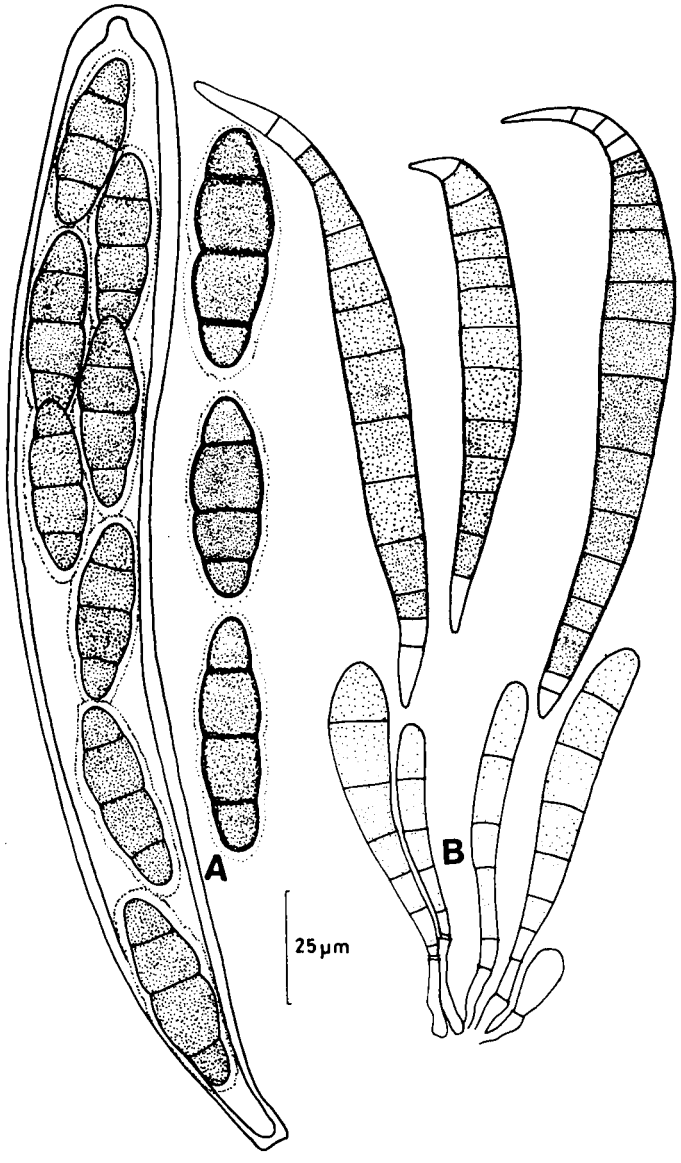


Fig. 202. *Asteromassaria macrospora*. A, ascus and ascospores; B, conidiophores and conidia.

Acervuli corticolous, immersed, brown, single, up to 250 µm in diam., opening by an irregular rupture of the overlying tissue. The wall is composed of pale brown, rather thin-walled angular cells. Conidiophores

branched at the base, cylindrical, hyaline, 1-2 septate, up to 30 μm long, 3-5 μm thick, formed from the upper cells of the acervulus. Conidiogenous cells holoblastic, 1-2 annellate, cylindrical, hyaline. Conidia smooth, fusiform, curved, pale brown with end cells paler or hyaline, 7-17 transversely septate, 100-190 × 12-15 μm, with a tapered obtuse apex and a truncate base. The pycnidial state is sometimes found mixed with or growing in conidiomata of *Asterosporium asterospermum*

On twigs of *Fagus*. Austria, UK, U.S.A.

COCHLIOBOLUS Drechsler, *Phytopathology* **24:** 973, 1934.

Pseudocochliobolus Tsuda, Ueyama & Nishihara, *Mycologia* **69:** 1117, 1977.

Type sp.: *C. heterostrophus* (Drechsler) Drechsler, *Phytopathology* **24:** 973, 1934.

Anamorphs: *Curvularia* Boedijn and *Drechslera* Ito (= *Bipolaris* Shoem., *Can. J. Bot.* **37:** 882, 1959).

Pseudothecia globose, ellipsoid or flask-shaped, dark brown to black, free or developing on a basal columnar or flat stromata, with a well-defined ostiolar beak or cylindrical neck, often covered with brown sterile hyphae on the upper half of the pseudothecium or with few hyaline cells at the apex of the beak. The pseudothecial wall is composed of pseudoparenchymatic cells more or less of equal thickness or slightly more thickened above. Asci numerous, thin-walled, cylindrical to broadly clavate, 1-8, mostly 8 spored, arising from a basal hymenium of hyaline thin-walled cells. Ascospores filiform, hyaline but may become pale brown, multiseptate, occasionally constricted at the septa, sometimes with a thin hyaline mucilaginous sheath, strongly helicoid to loosely coiled in the ascus. Pseudoparaphyses hyaline, filiform, septate and branched.

Tsuda, Ueyama & Nishihara (1977) erected *Pseudocochliobolus* to include those *Cochliobolus* species in which the pseudothecia develop from a columnar or flat stromata and with ascospores arranged often parallel to loosely coiled in the ascus. These characters, however, are not constant as pseudothecia may develop with or without a stromata and strongly helicoid to loosely arranged ascospores are often found in a single species. *Pseudocochliobolus* is, therefore, included as a synonym of *Cochliobolus*. Since then Alcorn in *Mycotaxon* **16:** 353-379 (1983) has placed it as a synonym of *Cochliobolus*.

The hyphomycete anamorph *Curvularia* produces darkly pigmented conidia with three or more septa, with the central cells enlarged and often asymmetrical so that the conidia appear curved. Mycelium, conidiophores and conidia are generally brown. Cultures are generally grown on PDA and produce stromata on corn meal agar with unpolished rice grains. Conidiophores are usually unbranched, geniculate, septate, straight, flexuous. Conidiogenous cells, polytretic, integrated, terminal, sometimes later becoming intercalary, sympodial, cylindrical or sometimes swollen, cicatrized. Conidia solitary or sometimes formed in chains, acropleurogenous, simple, clavate, ellipsoidal, broadly fusiform, obovoid or pyriform, in most species curved, hooked or sigmoid,

three or more septate, with the end cells often much paler than the others, smooth to verruculose or tuberculate, hilum in some species protuberant.

Drechslera is an important hyphomycete causing economic diseases of several important graminicolous and other crops. Mycelia brown, grey to black. Conidiophores straight to flexuous, often geniculate, usually unbranched, sometimes branched, smooth in most species. Conidiogenous cells polytretic, integrated, terminal, sympodial, cicatrized. Conidia solitary, in some species catenate or forming secondary conidiophores and conidia, acropleurogenous, simple, straight or curved, clavate, obclavate, ellipsoidal, fusiform, rostrate, pale to dark brown to olivaceous, smooth, rarely verruculose, distoseptate, hilum protuberant in some species. About 73 or more species (Ellis, 1971, 1976; Makela, 1971; Shoemaker 1959, 1962, Subramanian & Jain, 1966) described on different hosts with ascus state known for about 34 species. Perfect states belong to the genera *Cochliobolus* (25), *Pyrenophora* (12) and *Setosphaeria* (7). *Pyrenophora* and *Setosphaeria* have setose pseudothecia with dictyoseptate ascospores in the former and transversely septate ascospores in the latter. *Cochliobolus* has filiform ascospores. Those *Drechslera* species with a protuberant hilum (= *Exserohilum* Leonard & Suggs, *Mycologia* **66**: 289, 1974) have a *Setosphaeria* teleomorph (Luttrell, 1977).

Key to Cochliobolus species with Curvularia anamorph

Conidia with a protuberant hilum, almost always 4 septate... *C. cymbopogonis*

Conidia without a protuberant hilum..... 1

1. Conidia 3 septate..... 2

   Conidia 4 septate..... *C. geniculatus*

2. Conidia almost always curved..... *C. lunatus*

   Conidia straight or slightly curved..... *C. intermedius*

C. cymbopogonis Hall & Sivan., *Trans.Br.mycol.Soc.* **59**: 315, 1972 (Fig. 203).

Anamorph: *Curvularia cymbopogonis* (Dodge) Groves & Skolko, *Can. J. Res.* **23**: 96, 1945 (as '*cymbopogi*').

Helminthosporium cymbopogonis Dodge, *Ann.Mo.bot.Gdn* **29**: 139, 1942 (as '*cymbopogi*').

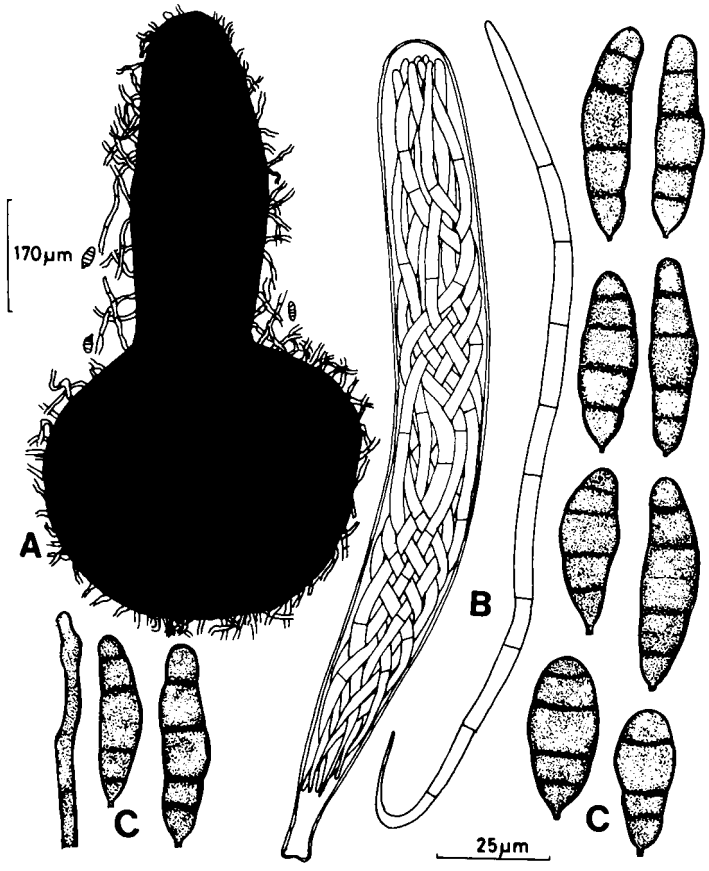


Fig. 203. *Cochliobolus cymbopogonis* (type). A, pseudothecium; B, ascus and ascospores; C, conidiophore and conidia.

Pseudothecia scattered to aggregated in concentric zones in the agar and on sterilized wheat straw in agar, superficial, up to 575 µm broad with a long cylindrical beak. Asci 8 spored, 210-275 × 15-23 µm. Ascospores 8-14 (commonly 10-12) septate, ends flagellate to somewhat tapered, 195-420 × 3.5-4.5 µm.

Conidiophores up to 300 µm long. Conidia straight, sometimes curved, clavate to ellipsoidal, obconical at the base which has a protuberant hilum, 4 septate, smooth, reddish brown to dark reddish brown, often

with end cells paler, on natural substrata 35-60 × 14-20 μm, in culture 30-46 × 11-17 μm. This species is homothallic.

On *Andropogon, Cymbopogon, Hyparrhenia, Loudetia, Oryza, Pinus, Sorghum* and *Zea*. Cuba, Denmark, Gambia, Ghana, Nigeria, Sierra Leone, Sudan, Togo, Venezuela, Zambia and Zimbabwe.

C. geniculatus Nelson, *Mycologia* **56:** 778, 1964 (as '*geniculata*') (Fig. 204c).

Pseudocochliobolus geniculatus (Nelson) Tsuda, Ueyama & Nishihara, *Mycologia* **69:** 1118, 1977.

Anamorph: *Curvularia geniculata* (Tracy & Earle) Boedijn, *Bull.Jard. bot.Buitenz.* III, **13:** 129, 1933.

Helminthosporium geniculatum Tracy & Earle, *Bull. Torrey bot Club* **23:** 207, 1896.
Brachysporium sesami Saw., *Spec.Publ.Coll.Agric.Nat.Taiwan Univ.* **8:** 198, 1959.

Pseudothecia free or frequently developing on a columnar stroma, upto 830 μm broad. Asci 1-8 spored, 170-290 × 15-20 μm. Ascospores somewhat tapered at the ends, 6-16 septate, 160-270 × 4-7 μm. The species is heterothallic.

Conidiophores up to 600 μm long. Conidia usually curved, geniculate, fusiform, 3-4 septate but almost always 4 septate, rarely 5 septate, end cells subhyaline or very pale brown, intermediate cells brown to dark brown, the central cell usually darker brown and swollen, smooth, 26-48 × 8-13 μm on natural substrata and 18-37 × 8-14 μm in culture.

Cosmopolitan and common throughout the tropics on different substrata in the conidial state.

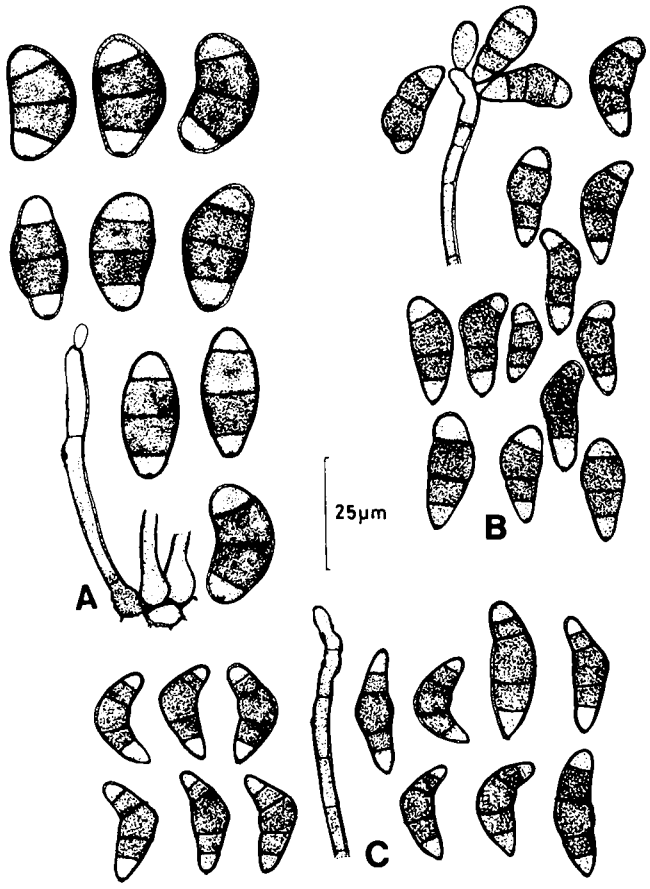


Fig. 204. *Cochliobolus intermedius.* A, conidiophores and conidia. *C. lunatus.* B, conidiophore and conidia. *C. geniculatus.* C, conidiophores and conidia.

C. intermedius Nelson, *Mycologia* **52:** 776, 1961 (Fig. 204A).

Anamorph: *Curvularia intermedia* Boedijn, *Bull.Jard.bot.Buitenz.* III, **13:** 126, 1933.

Pseudothecia up to 560 µm broad. Asci 1-8 spored, 130-250 × 14-25 µm. Ascospores somewhat tapering at the ends, 5-9 septate, 165-330 × 5-10 µm.

The species is heterothallic. Conidiophores about 1 mm or more long, 5-9 µm wide. Conidia straight or somewhat curved, more or less ellipsoidal or broadly fusiform, but always somewhat unequal-sided,

smooth, 3 septate, with a truly median middle septum cutting the conidium transversely at its widest point, basal cell often the narrowest, end cells subhyaline to pale brown, intermediate cells brown to dark brown, 27-40(32) μm long, 13-20(15.5) μm thick in the broadest part.

On *Cynodon, Oryza, Triticum, Zea.* Australia, Papua New Guinea, Tanzania, U.S.A.

C. lunatus Nelson & Haasis, *Mycologia* **56:** 316, 1964 (as '*lunata*') (Fig. 204B).

Pseudocochliobolus lunatus (Nelson & Haasis) Tsuda, Ueyama & Nishihara, *Mycologia* **69:** 1118, 1977.

Anamorph: *Curvularia lunata* (Wakker) Boedijn, *Bull.Jard.bot.Buitenz.* III, **13:** 127, 1933.

Acrothecium lunatum Wakker in Wakker & Went, *Die Ziekten van het suikerriet op Java:* 196, 1898.

Pseudothecia up to 530 μm broad, free or on a columnar stroma, solitary or grouped in two's or more. Asci 1-8 spored, 160-300 × 10-20 μm. Ascospores 6-15 μm septate, 130-270 × 5-6.5 μm.

Conidiophores upto 650 μm long. Stromata rarely formed on rice grains. Conidia 3 septate, almost always curved at the third cell from the base which is usually larger and often darker than the others, end cells subhyaline or pale brown, intermediate cells brown to dark brown, smooth, 20-32 × 9-15 μm, on natural substrata 18-30 × 9-14 μm. The species is heterothallic. Common on many different substrates. Cosmopolitan. Ellis & Gibson (1975b) have given a brief note on the pathogenicity, transmission and control of this leaf spot and seed blight fungus.

Recently Tsuda & Ueyama (*Mycologia* **74:** 565, 1982) have connected *Curvularia verruculosa* Tandon & Bilgrami ex M.B.Ellis to a *Pseudocochliobolus* teleomorph, *P. verruculosus* Tsuda & Ueyama, *Mycologia* **74:** 565, 1982. This is transferred to *Cochliobolus* as *C. verruculosus* (Tsuda & Ueyama) comb. nov.

Key to Cochliobolus species with Drechslera anamorph

Conidia less than 42 μm long..... 1

Conidia often more than 42 μm long..... 4

1. Conidia 11 μm wide or less..... *C. hawaiiensis*

   Conidia up to 13 μm wide or more..... 2

2. Conidia always 3 distoseptate..... *C. spicifer*

   Conidia 3 or more distoseptate..... 3

3. Conidia 6-20 μm wide..... *C. australiensis*

   Conidia 10-13 μm wide..... *C. homomorphus*

4. Conidiophores often branched..... 5

   Conidiophores very rarely branched..... 6

5. Conidia ovoid to clavate..... *C. nodulosus*

   Conidia oblong or ellipsoidal..... *C. ravenelii*

   Conidia cylindrical to fusiform..... *C. tripogonis*

6. Conidia mostly straight..... 7

   Conidia mostly curved..... 8

7. Conidia with end cells often much paler than the others..... *C. bicolor*

   Conidia with end cells not paler but the basal cell may be slightly paler than the other cells..... *C. nisikadoi*

8. Conidia with minute hilum often slightly protruding and papillate..... *C. miyabeanus*

   Conidia with hilum not protruding..... 9

9. Conidia mostly not more than 20 μm wide..... 10

   Conidia mostly more than 20 μm wide..... *C. sativus*

10. Conidia averaging 50 μm long..... *C. cynodontis*

    Conidia mostly more than 50 μm long..... 11

11. Conidia mostly 10-15 μm wide..... *C. setariae*

    Conidia mostly 12-20 μm wide..... 12

12. Conidia dark with paler end cells..... *C. carbonum*

    Conidia pale..... 13

13. Conidia not more than 100 μm long..... 14

    Conidia mostly more than 100 μm long..... 15

14. Conidia 35-100 μm long..... *C. chloridis*

    Conidia 25-66 μm long..... *C. kusanoi*

15. Conidia 40-120 μm long..... *C. victoriae*

    Conidia 70-160 μm long..... *C. heterostrophus*

C. australiensis (Tsuda & Ueyama) Alcorn, *Mycotaxon* **16:** 373, 1983.

Pseudocochliobolus australiensis Tsuda & Ueyama, *Mycologia* **73:** 92, 1981.

Anamorph: *Drechslera australiense* M.B. Ellis, *Dematiaceous Hyphomycetes:* 415, 1971.

Helminthosporium australiensis Bugnicourt, *Rev.Gen.Bot.* **62:** 242, 1955(not valid).
Bipolaris australiensis (M.B.Ellis) Tsuda & Ueyama, *Mycologia* **73:** 90, 1981.

Pseudothecia formed on a flat stroma, with long necks. Asci 1-8 (mostly 6-8) spored, 106-181 × 8.5-15 μm. Ascospores 3-13 (mostly 7-10) septate, 81-206 × 2.5-6 μm.

Conidiophores upto 150 μm long, 3-7 μm wide. Conidia straight, ellipsoidal or oblong, rounded at the ends, pale brown to mid brown, at least 80% 3 distoseptate, rarely with 4 or 5 septa, 13-40 × 6-20 μm.
The species is heterothallic.

Isolated from *Chloris, Lycopersicon, Oryza* (grains) and a wide variety of other graminicolous and dicotyledonous host. Australia, India, Japan, Kenya.

C. bicolor Paul & Parbery, *Trans.Br.mycol.Soc.* **49:** 386, 1966 (Fig. 205).

Anamorph: *Drechslera bicolor* (Mitra) Subram. & Jain, *Curr.Sci.* **35:** 354, 1966.

Helminthosporium bicolor Mitra, *Trans.Br.mycol.Soc.* **15:** 286, 1931.
Bipolaris bicolor (Mitra) Shoem., *Can.J.Bot.* **37:** 884, 1959.

Pseudothecia upto 470 μm broad, with an ostiolar beak covered by a few hyaline cells at the apex. Asci 8 spored, commonly 2 or 4 spored, 130-208 × 14-23 μm. Ascospores somewhat pointed at the ends, hyaline, septate, 165-242 × 4-6.5 μm.

The species is heterothallic.

Conidiophores upto 400 μm, 5-10 μm wide. Conidia straight, sometimes slightly curved, cylindrical or slightly broader in the middle and tapering towards the ends, rarely obclavate, rounded at the apex, truncate at the base, 3-14 (mostly 5-9) distoseptate, 20-135 (mostly 40-80) × 12-20 (mostly 14-18) μm with central cells of mature conidia often dark brown or smokey grey and sometimes opaque and end cells hyaline to very pale, often cut off by a very dark septum, hilum 3-5 μm wide, dark and flat.

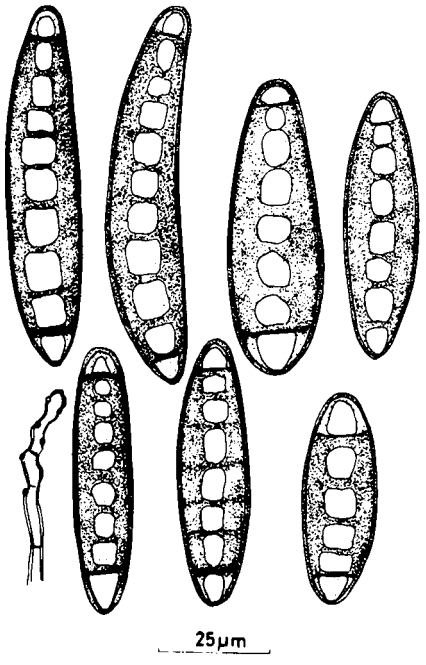


Fig. 205. *Cochliobolus bicolor.* Conidiophores and conidia.

On *Coriandrum, Cordyline, Eichornia, Musa, Pennisetum, Sorghum, Triticum;* Australia, E. & W. Africa, India.

C. carbonum Nelson, *Phytopathology* **49:** 809, 1959 (Fig. 206).

Anamorph: *Drechslera carbonum* (Ullstrup) comb. nov.

Helminthosporium carbonum Ullstrup, *Phytopathology* **34:** 219, 1944.

Pseudothecia upto 430 µm broad, setose over the upper third and frequently bearing conidiophores, with a well defined subconical to paraboloid ostiolar beak and often covered with a mass of hyaline cells at the apex. Ascospores somewhat tapering at the ends, hyaline, 5-9 septate, 180-310 × 6-9.5 µm.

The species is heterothallic.

Conidiophores up to 250 µm long, 5-8 µm wide. Conidia curved or sometimes straight, cylindrical but usually broader in the middle and tapering towards the rounded ends, 30-100 (mostly 60-80) × 12-18 µm,

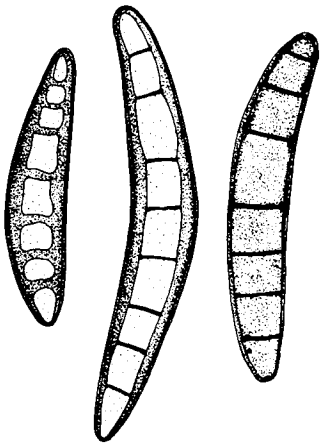


Fig. 206. *Cochliobolus carbonum*. Conidia.

6-13 (usually 7-8) distoseptate, olivaceous brown to dark or very dark brown with end cells sometimes remaining paler than the central cells; hilum not very distinct.

On *Zea mays,* affecting all aerial parts giving diseased ears a characteristic charred appearance. Occasionally on *Sorghum* and other grasses. In culture on wheat straw and T.W.A. black, thick-walled hyphae are formed which sometimes break up into segments. (Ellis & Holliday, 1972b).

Africa, N. America, India (CMI Distribution Map 380).

C. chloridis Alcorn, *Trans.Br.mycol.Soc.* **70:** 61, 1978 (Fig. 207).

Anamorph: *Drechslera chloridis* Alcorn, *Trans.Br.mycol.Soc.* **67:** 148, 1976.

Bipolaris chloridis (Alcorn) Alcorn, *Mycotaxon* **16:** 373, 1983.

Pseudothecia usually with a short conical beak, up to 650 μm broad. Asci 1-8 spored, 97-205 × 17-30 μm. Ascospores commonly tapered considerably on the base and less so at the rounded or sometimes acute apex, with a hyaline mucilaginous sheath 2-4 μm thick (visible in water mounts), 1-10 septate, occasionally constricted at some of the septa, 120-320 × 5-8.5 μm.

In common with many other species of *Cochliobolus, C. chloridis* is heterothallic.

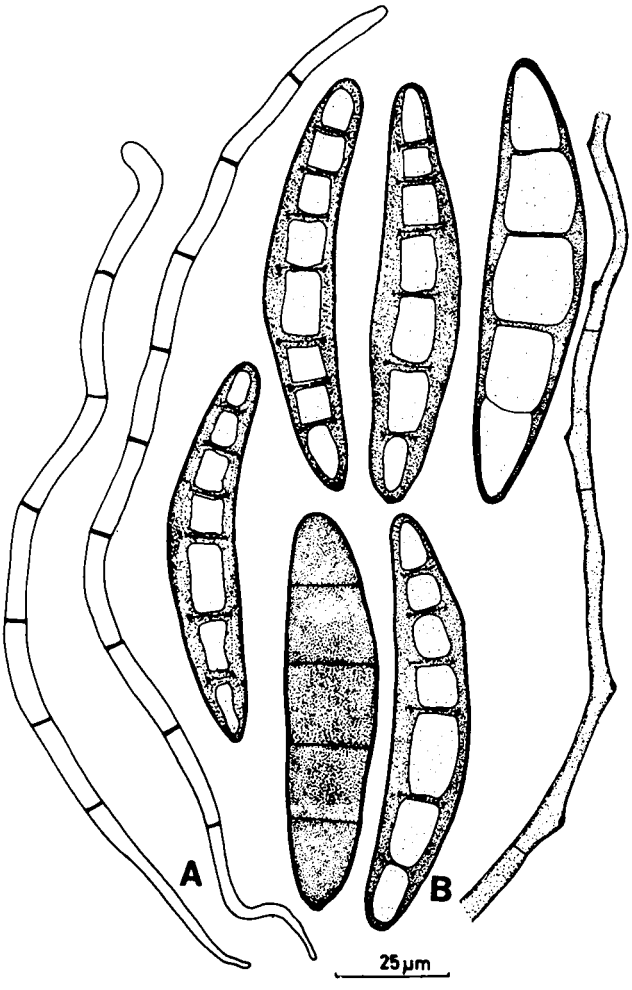


Fig. 207. *Cochliobolus chloridis.* A, ascospores; B, conidiophore and conidia.

The optimum temperature for pseudothecial development and maturation is in the range 22-26°C (Alcorn, 1978).

Conidial lesions occur commonly at the tips or margins of the leaf blades, initially greyish green, dying out to a bleached straw colour or more often grey, usually with a narrow reddish brown margin and sometimes a narrow chlorotic band outside that, 50-185 µm long, 1.5-5 mm wide. Less commonly the lesions are placed centrally in the lamina and do not extend at least one margin. Sporulation is amphige-

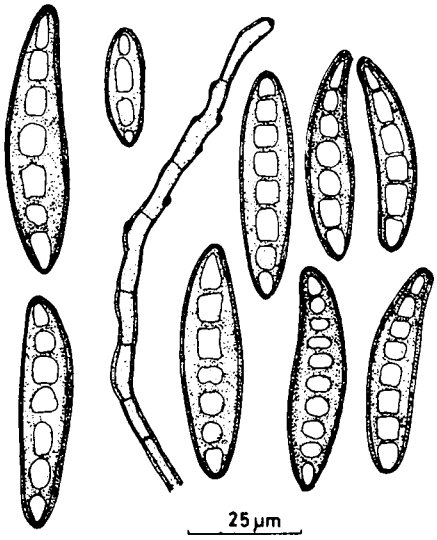


Fig. 208. *Cochliobolus cynodontis.* Conidiophores and conidia.

nous, sometimes more abundant on the lower surface. Conidiophores up to 380 µm long, 5-7 µm thick. Conidia pale golden brown to reddish brown, mostly curved, subcylindric to fusiform, ends rounded or base sometimes truncate, hilum inserted within the contour of the basal cell and rather inconspicuous, 3-4.5 µm diam., 2-9 (commonly 4-6) distoseptate, 35-100 × 10-20 µm. Secondary sporulation very rare. Conidiophores borne only sparingly on most pseudothecia.

On *Chloris gayana.* Australia, India, Kenya, Malawi, Tanzania, Zambia.

C. cynodontis Nelson, *Mycologia* **56:** 67, 1964 (Fig. 208).

Anamorph: *Drechslera cynodontis* (Marignoni) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium cynodontis Marignoni, *Micromiceti di Schio:* 27, 1909.
Bipolaris cynodontis (Marignoni) Shoem., *Can.J.Bot.* **37:** 883, 1959.

Pseudothecia upto 400 µm broad. Asci 1-8 spored, 140-210 × 16-28 µm. Ascospores 3-9 septate, 160-320 × 5.5-9.8 µm. Mature ascospores often surrounded by a thin mucilaginous sheath and germinate either terminally or laterally. Conidiophores and conidia often produced on the wall of the pseudothecium.

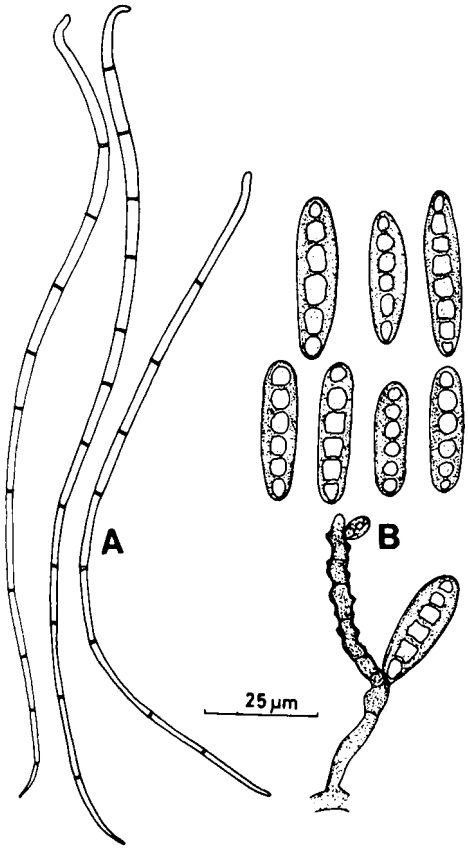


Fig. 209. *Cochliobolus hawaiiensis* (type). A, ascospores; B, conidiophores and conidia.

Conidiophores up to 170 µm long, 5-7 µm wide. Conidia mostly slightly curved sometimes almost cylindrical, usually broadest in the middle and tapering towards the rounded ends, pale to mid brown, smooth, 3-9 (usually 6-8) distoseptate, 30-75 × 10-16 µm with a dark hilum 2-3 µm wide. The fungus is heterothallic.

Common on *Cynodon* and on other grasses, also isolated from apple, pine and *Ipomoea* in the conidial state. Cosmopolitan.

C. hawaiiensis Alcorn, *Trans. Br. mycol. Soc.* **70:** 64, 1978 (Fig. 209).

Pseudocochliobolus hawaiiensis (Alcorn) Tsuda & Ueyama, *Mycologia* **73:** 92, 1981.

Anamorph: *Drechslera hawaiiensis* M. B. Ellis, *Dematiaceous Hyphomycetes:* 415, 1971.

Bipolaris hawaiiensis (M.B. Ellis) Tsuda & Ueyama, *Mycologia* **73:** 89, 1981.

Pseudothecia upto 450 μm broad and usually with a long straight cylindrical neck. Asci 125-205 × 10-18 μm, 1-8 spored. Ascospores tapered to the acute apex and more gradually in the lower half, with a thin hyaline sheath, 85-190 × 2.5-6 μm, 4-15 septate.

The optimum temperature for ascocarp formation and maturation of asci is 26 °C (Alcorn, 1978). The species is heterothallic.

Conidial colonies effuse, grey dark brown to black. Stromata sometimes formed in culture. Conidiophores up to 120 μm long, 2-7 μm wide. Conidia straight ellipsoidal, oblong or cylindrical, rounded at the ends, pale to mid brown, 2-7 (mostly 5) distoseptate, 12-37 × 5-11 μm.

Isolated from many graminicolous and many other different plants, from soil, textiles and other substrata. Widespread in the tropics.

C. heterostrophus (Drechsler) Drechsler, *Phytopathology* **24:** 973, 1934 (Fig. 210).

Ophiobolus heterostrophus Drechsler, *J. Agric. Res.* **31:** 723, 1925.

Anamorph: *Drechslera maydis* (Nisikado) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium maydis Nisikado, *Sci. Res. Alumni Assoc. Morioka agric. Col. Japan* **3:** 46, 1926.
Bipolaris maydis (Nisikado) Shoem., *Can. J. Bot.* **37:** 882, 1959.

Pseudothecia bearing conidiophores, upto 600 μm diam. Asci 1-8 (commonly 4) spored, 160-180 × 24-28 μm. Ascospores hyaline to light olivaceous, somewhat constricted at the septa, 130-340 × 6-9 μm.

Conidiophores up to 700 μm long, 5-10 μm wide. Conidia characteristically curved, pale to mid dark golden brown, smooth, fusiform, 5-11 distoseptate, 70-160 × 15-20, hilum 3-4.5 μm wide.

On diseased leaves of *Zea,* also on *Sorghum* and other grasses; widely distributed throughout the tropics (CMI Distribution Map 346). Recently the formation of pseudothecia on a dialyzing membrane (Fukuki & Aragaki, 1973) and protothecia (Leonard, 1972) of *C. heterostrophus* has been described. Nelson (1959) has discussed the genetic factors inhibiting ascus formation. Ellis & Holliday (1971a) have given a brief note on the disease, physiologic specialization and transmission.

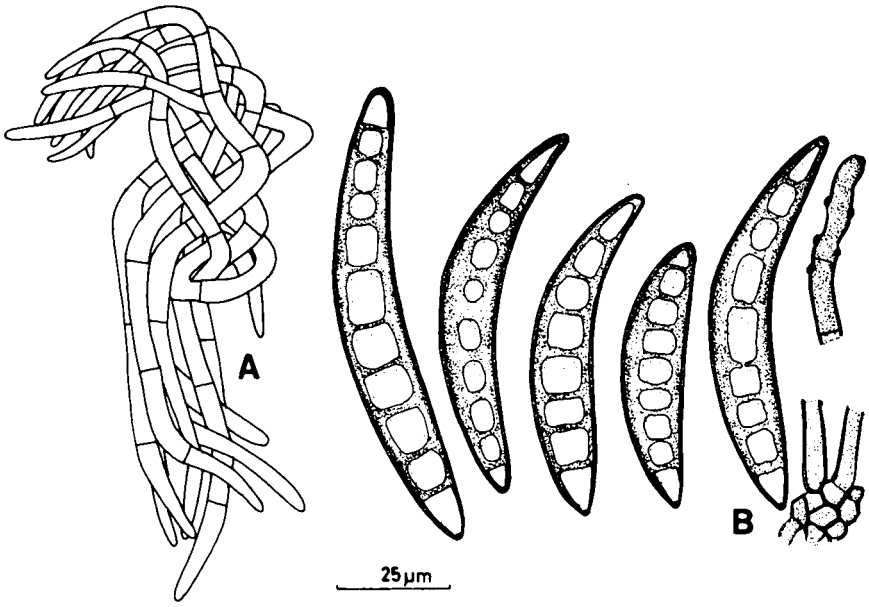


Fig. 210. *Cochliobolus heterostrophus.* A, ascospores; B, conidiophore and conidia.

C. homomorphus Luttr. & Rogerson, *Mycologia* **51:** 195, 1959 (Fig. 211).

Anamorph: *Drechslera homomorpha* (Luttr. & Rogerson) comb. nov.

Helminthosporium homomorphus Luttr. & Rogerson, *Mycologia* **51:** 195, 1959. *Bipolaris homomorphus* (Luttrell & Rogerson) Alcorn ex Subram., *Mycotaxon* **16:** 374, 1983.

Pseudothecia superficial or immersed, globose, upto 735 µm broad with a broad cylindrical beak. Asci 8 spored, 125-225 × 13-20 µm. Ascospores hyaline, 6-9 septate, slightly constricted at the septa, 132-305 × 3-4.6 µm. The species is homothallic.

Conidiophores up to 90 µm long, 5-7 µm thick. Conidia formed singly at the apex, acropleurogenous, broadly ellipsoid, oblong or obclavate, straight, widest in the upper third, pale to mid dark brown or golden brown, 3-6 distoseptate, 25-42 × 10-13 µm, hilum dark, small and included within the contour of the wall at the base. Secondary conidiophores and conidia produced by germination at both ends.

From air-borne spores cultured on segments of *Hordeum vulgare* straw in agar. U.S.A.

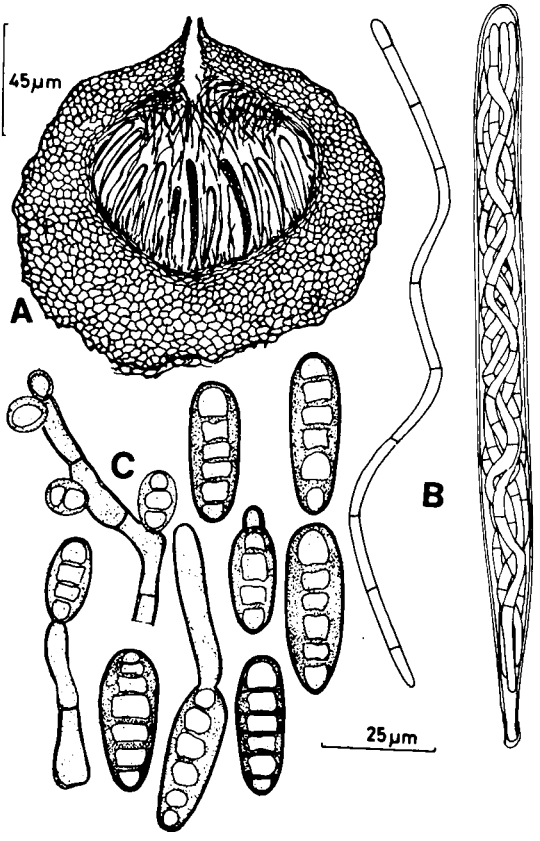


Fig. 211. *Cochliobolus homomorphus* (type). A, v.s. pseudothecium; B, ascus and ascospore; C, conidiophore and conidia.

C. kusanoi (Nisikado) Drechsler ex Dastur, *Ind. J. agric. Sci.* **12:** 733, 1942 (Fig. 212).

Ophiobolus kusanoi Nisikado, *Jap. Journ. Bot.* **6:** 108, 1928.

Anamorph: *Drechslera kusanoi* (Nisikado) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium kusanoi Nisikado, *Ohara Nogyo Kenkyusho Tokubetsu Hokoku (Ohara Inst. Agric. Res. Sp. Rep.)* **4:** 150, 1928.
Bipolaris kusanoi (Nisikado) Shoem., *Can. J. Bot.* **37:** 883, 1959.

Pseudothecia upto 350 µm broad with a short ostiolar beak. Asci 8 spored, 130-182 × 14-18 µm. Ascospores, 6-8(14) septate, constricted at the septa, 140-170 × 4-5 µm.

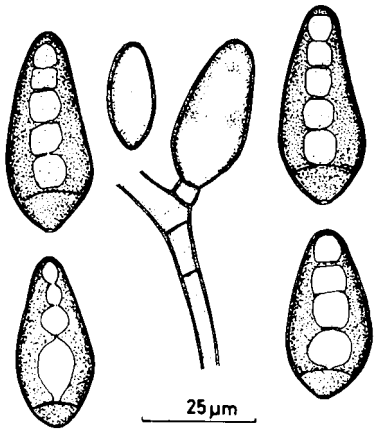


Fig. 212. *Cochliobolus kusanoi.* Conidiophore and conidia.

The species is homothallic.

Conidiophores up to 250 µm long, 5-7 µm wide. Conidia obclavate or long elliptical, tapering towards a rounded apex, pale to dark olivaceous brown, 3-5, often 4 distoseptate, 25-66 × 11-20 µm, hilum dark, 2-4 µm wide.

On *Eragrostis,* Japan. Recently Waki *et al.* (1979) has described the culture conditions for obtaining the perfect state.

C. miyabeanus (Ito & Kurib.) Drechsler ex Dastur, *Indian J. agric. Sci.* **12:** 733, 1942 (Fig. 213).

Ophiobolus miyabeanus Ito & Kurib., *Ann. Phytopath. Soc. Japan* **2:** 7, 1927.

Anamorph: *Drechslera oryzae* (Breda de Haan) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium oryzae Breda de Haan, *Bull. Inst. bot. Buitenz.* **6:** 11-13, 1900.
Helminthosporium oryzae Miyabe & Hori in Hori, *Rept. Imp. Centr. Agric. Exp. Stn., Nishigohara, Japan* **18:** 79, 1901.
Bipolaris oryzae (Breda de Haan) Shoem., *Can. J. Bot.* **37:** 883, 1959.
Luttrellia oryzae (Breda de Haan) Gornostai (as *'Lutrellia')* in Azbukina *et al.* (Eds.), *Vodorosli, Gribỹ i Mkhi Dal' nego Vostoka* (Vladirostoc): 81, 1978.

Pseudothecia upto 780 µm broad with a cylindrical to conical ostiolar beak. Asci 1-8 (commonly 4 or 8) spored, 140-275 × 20-36 µm. Asco-

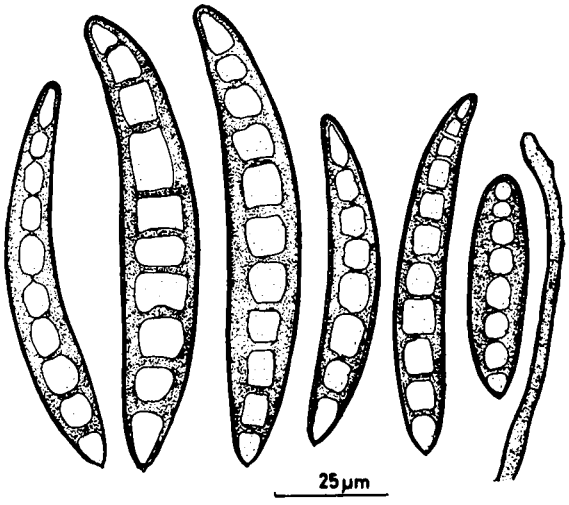


Fig. 213. *Cochliobolus miyabeanus*. Conidiophore and conidia.

spores somewhat tapering at the ends, hyaline but light olivaceous in mass, 6-16 septate, 235-470 × 6-9 µm. Many hyphae and conidiophores are formed in young pseudothecia.

Conidiophores up to 600 µm long, 4-8 µm wide. Conidia navicular, fusiform, obclavate or almost cylindrical, often curved, pale brown to golden brown, smooth, 6-14 distoseptate, 63-153(100) × 14-22(17) µm, hilum minute, often slightly protruding, papillate. Conidia formed in culture and on glumes are usually larger and darker than those formed on leaf spots.

On *Oryza* causing brown spot disease. Cosmopolitan (CMI Distribution Map 92). The formation of the ascus state and its sexuality has been described by Ueyama & Tsuda (1975a,b; 1976) and by Tsuda & Ueyama (1975). A brief note on the disease, transmission and physiologic specialization has been given by Ellis & Holliday (1971b).

C. nisikadoi (Tsuda, Ueyama & Nishihara) Alcorn, *Mycotaxon* **16:** 373, 1983 (Fig. 214)

Pseudocochliobolus nisikadoi Tsuda, Ueyama & Nishihara, *Mycologia* **69:** 1117, 1977.

Anamorph: *Drechslera coicis* (Nisikado) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

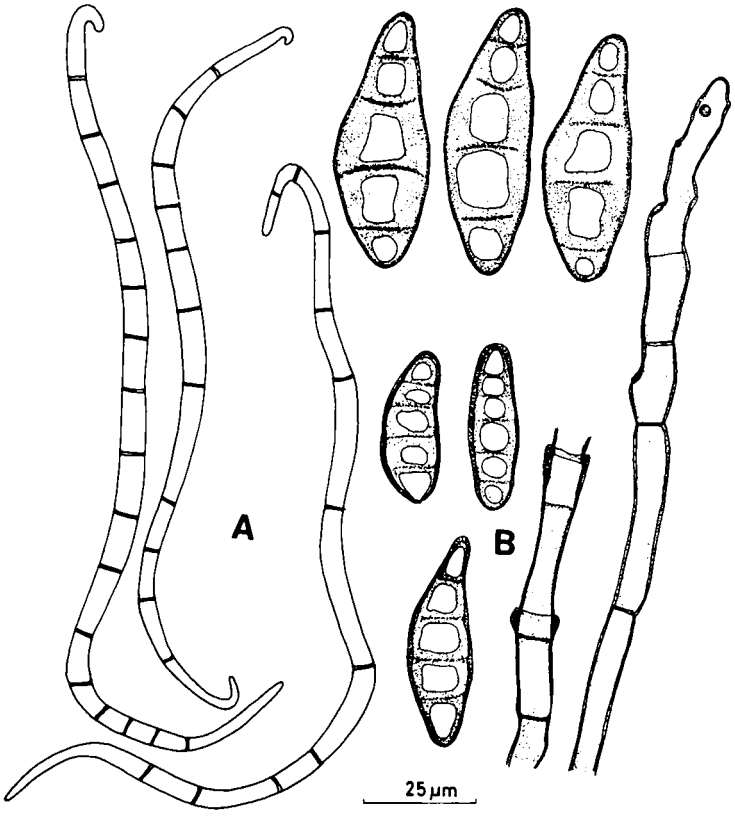


Fig. 214. *Cochliobolus nisikadoi.* A, ascospores; B, conidiophores and conidia.

Helminthosporium coicis Nisikado, *Ohara Inst.Agric.Res. Sp. Rep.* **4:** 136, 1928.
Bipolaris coicis (Nisikado) Shoem., *Can. J. Bot.* **37:** 883, 1955.
Curvularia coicis Castell., *Nuovo G. bot. Ital.* **62:** 554, 1955.

Pseudothecia developing from a columnar or flat stromata, upto 700 µm broad, setose. Asci 1-8 (mostly 4) spored, 100-260 × 10-16 µm. Ascospores 7-16 septate, hyaline to subhyaline, 116-288 × 3.5-7.2 µm.

Conidiophores up to 200 µm long, 6-11 µm wide. Conidia straight or sometimes slightly curved, 4-5 distoseptate, 40-64 × 17-23 µm, hilum 3-5 µm wide.

On leaves of *Coix,* also isolated from *Thysanolaena* and *Zea.* Brazil, Japan, India, Papua New Guinea.

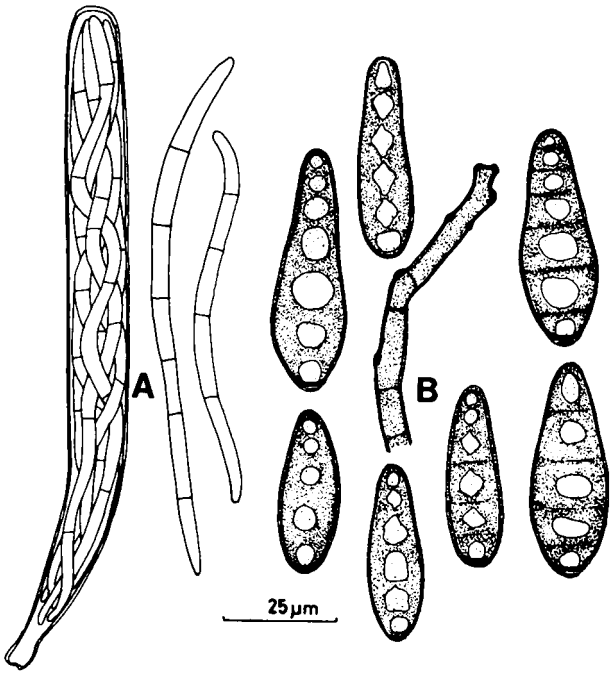


Fig. 215. *Cochliobolus nodulosus.* A, ascus and ascospores; B, conidiophore and conidia.

C. nodulosus Luttr., *Phytopathology* **47:** 547, 1957 (Fig. 215).

Anamorph: *Drechslera nodulosa* (Berk. & M.A. Curtis) Subram. & Jain, *Curr.Sci.* **35:** 354, 1966.

Helminthosporium nodulosum Berk. & M.A. Curtis, *Syll. Fung.* **4:** 421, 1886.
Bipolaris nodulosa (Berk. & M.A. Curtis) Shoem., *Can.J.Bot.* **37:** 883, 1959.
Helminthosporium leucostylum Drechsler, *J. agric.Res.* **24:** 711, 1923.
Helminthosporium nodosum Berk. & M.A. Curtis in Berk., *Grevillea* **3:** 102, non Wallr., *Fl.Crypt.Germ.* **2:** 165, 1833.
Bipolaris leucostyla (Drechsler) Shoem., *Can.J.Bot.* **37:** 883, 1959.

Pseudothecia upto 420 µm broad with long necks. Asci 1-8 spored, 120-193 × 14-17 µm. Ascospores hyaline, 3-11 septate, constricted at the septa in the middle part, 90-193 × 4-8 µm.

Conidiophores often branched, upto 150 µm long, 5-9 µm wide. Conidia straight, ovoid to obclavate, pale to dark golden brown, 5-7 distoseptate, 43-80 × 16-19 µm, hilum 3-4 µm wide, usually with a hyaline area just above it and then a dark area. The species is heterothallic.

On *Eleusine* causing spots and stripes on leaves and sooty growth on the inflorescences. Also found on *Pennisetum* and soil. Brazil, Ethiopia, India, Kenya, Mauritius, Papua New Guinea, Sierra Leone, S.Africa, Tanzania, Uganda, Zambia, U.S.A. Ellis & Holliday (1972a) have given a brief note on the disease and a brief description of the anamorph.

C. ravenelii Alcorn, *Mycotaxon* **13:** 341, 1981.

Anamorph: *Drechslera ravenelii* (M.A. Curtis) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium ravenelii M.A. Curtis, *Am. J. Sci.* **6:** 352, 1848.
Helminthosporium tonkinense Karsten & Roum., *Rev. mycol.* **12:** 78, 1890.
Bipolaris ravenelii (M.A. Curtis) Shoem., *Can.J.Bot.* **37:** 884, 1959.

Pseudothecia up to 135 μm broad. Asci 185-300 × 14-17.5 μm. Ascospores 5-14 septate, 155-310 × 5-7.5 μm.

Conidiophores closely packed, often branched, up to 600 μm long, 15-10 μm wide. Conidia oblong, rounded at the ends or ellipsoidal, mid golden brown, 1-6 distoseptate, 30-80 × 13-19 μm, hilum 2 μm wide.

On inflorescences and grains of *Sporobolus* spp. and other grasses. Cosmopolitan.

C. sativus (Ito & Kurib.) Drechsler ex Dastur, *Ind.J.agric.Sci* **12:** 733, 1942 (Fig. 216).

Ophiobolus sativus Ito & Kurib. in Kurib., *Trans.Sapporo nat.Hist.Soc.* **10:** 138, 1929.

Anamorph: *Drechslera sorokiniana* (Sacc.) Subram. & Jain, *Curr.Sci.* **35:** 354, 1966.
Helminthosporium sorokinianum Sacc. in Sorok., *Trans.Soc.Nat.Univ.Kazan* **22:** 15, 1890.
Bipolaris sorokiniana (Sacc.) Shoem., *Can. J. Bot.* **37:** 884, 1959.
Helminthosporium sativum Pammel, King & Bakke, *Bull. Iowa agric. Exp.* Stn. **116:** 180, 1910.
Helminthosporium californicum Mackie & Paxton, *Phytopathology* **13:** 562, 1923.
Helminthosporium acrothecioides Lindfors, *Svensk bot. Tidskr.* **12:** 277, 1918.

Pseudothecia upto 530 μm broad. Asci 1-8 (mostly 4-6-8) spored, 110-230 × 30-45 μm. Ascospores hyaline or light brown, 6-13 septate, 160-360 × 6-9 μm, often covered by a mucilaginous sheath. Conidiophores and sterile hyphae are often produced on young pseudothecia.

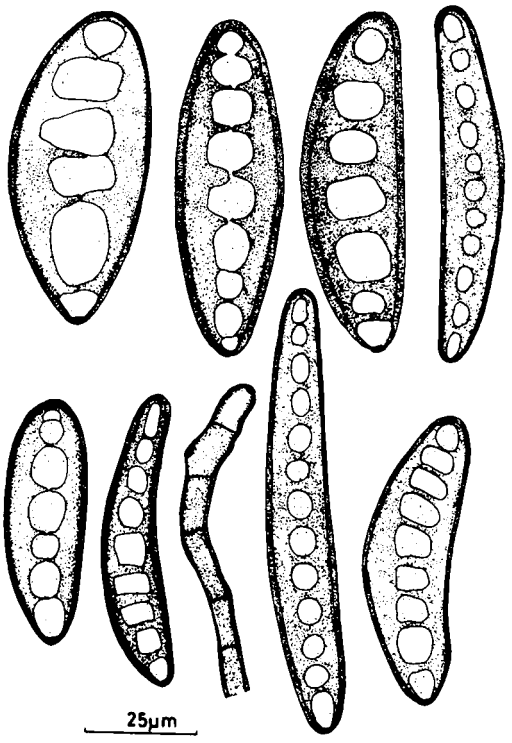


Fig. 216. *Cochliobolus sativus.* Conidiophore and conidia.

Conidiophores up to 225 µm long, 6-10 µm wide. Conidia curved to straight, fusiform to broadly cylindrical, 3-12 (commonly 6-10) distoseptate, 40-120 (mostly 60-100) × 17-28 µm.

The species is heterothallic. Tinline (1951) has described the method of producing pseudothecia in culture. Shoemaker (1955) has discussed the biology, cytology and taxonomy of this species (Sivanesan, A. & Holliday, P., CMI Descr. 701, 1981).

Common on various grasses causing dark brown elongated spots on leaves, foot rot and seedling blight. Cosmopolitan (CMI Distribution Map 346).

C. setariae (Ito & Kurib.) Drechsler ex Dastur, *Ind. J. agric. Sci.* **12:** 733, 1942 (Fig. 217).

Ophiobolus setariae Ito & Kurib., *Proc.Im.Acad.Sci.* **6:** 352, 1930.

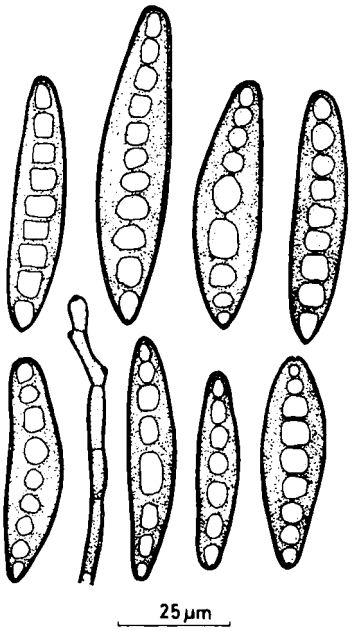


Fig. 217. *Cochliobolus setariae.* Conidiophore and conidia.

Anamorph: *Drechslera setariae* (Saw.) Subram. & Jain, *Curr.Sci.* **35:** 354, 1966.

Helminthosporium setariae Saw., *Formosa Dept.Agric.Bull.* **64:** 19, 1912.
Bipolaris setariae (Saw.) Shoem., *Can.J.Bot.* **37:** 884, 1959.

Pseudothecia flask-shaped, up to 315 µm broad. Asci 1-8 spored, 130-280 × 22-32 µm. Ascospores with ends somewhat tapered, hyaline, light olivaceous in a mass, coiled in a close helix in the ascus, 200-315 × 6-7 µm.

Conidiophores up to 200 µm long, 5-9 µm thick. Conidia slightly curved or straight, fusiform or navicular, pale to golden brown, smooth 5-10 distoseptate, 45-100 (mostly 50-70) × 10-15 µm. A brief note on the disease caused by this species is given by Ellis & Gibson (1975a).

On *Setaria italica,* Europe, N.America, Africa, Asia.

C. spicifer Nelson, *Mycologia* **56:** 198, 1964 (as *'spiciferus'*) (Fig. 218).

Pseudocochliobolus spicifer (Nelson) Tsuda, Ueyama & Nishihara, *Mycologia* **69:** 1119, 1977.

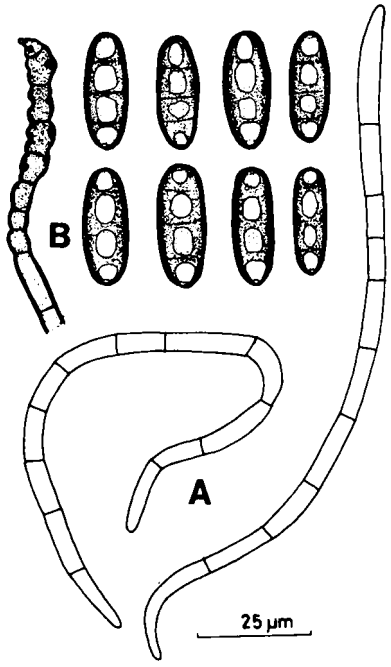


Fig. 218. *Cochliobolus spicifer.* A, ascospores; B, conidiophore and conidia.

Anamorph: *Drechslera spicifera* (Bainier) von Arx, *The genera of fungi sporulating in pure culture:* 222, 1970.

Brachycladium spiciferum Bainier, *Bull.Soc.mycol.Fr.* **24:** 81, 1908.
Curvularia spicifera (Bainier) Boedijn, *Bull.Jard.bot.Buitenz.* III, **13:** 127, 1933.
Helminthosporium spiciferum (Bainier) Nicot, *Ost.Bot.Z.* **100:** 482, 1953.

Pseudothecia up to 650 µm broad. Pseudothecia usually develop from a columnar stroma or may develop directly without a stroma. Asci 1-8 spored, 130-260 × 12-20 µm. Ascospores somewhat tapered at the ends, hyaline, 6-16 septate, 135-240 × 3.5-7 µm, arranged in a close helix in the ascus.

Conidiophores up to 400 µm long, 4-9 µm thick. Conidia straight, oblong or cylindrical, rounded at the ends, golden brown when mature except remaining hyaline or very pale for a small area just above the scar, smooth, always 3 distoseptate, 20-40 (mostly 30-36) × 9-14 µm, with a hilum 2-4 µm wide.

The species is heterothallic. (Sivanesan, A. & Holliday, P., CMI Descr. 702, 1981).

Cosmopolitan and common in their conidial state.

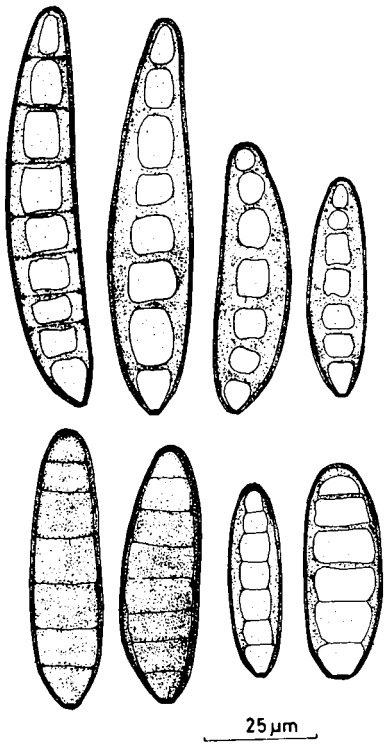


Fig. 219. *Cochliobolus victoriae.* Conidia.

C. victoriae Nelson, *Phytopathology* **50:** 774, 1960 (Fig. 219).

Anamorph: *Drechslera victoriae* (Meehan & Murphy) Subram. & Jain, *Curr.Sci.* **35:** 355, 1966.

Helminthosporium victoriae Meehan & Murphy, *Science* **104:** 413, 1946.
Bipolaris victoriae (Meehan & Murphy) Shoem., *Can.J.Bot.* **37:** 882, 1959.

Pseudothecia upto 370 µm broad, setose, often bearing conidiophores. Asci 1-8 spored, 98-210 × 20-40 µm. Ascospores hyaline, 5-9 septate, 140-302 × 6-13 µm, surrounded by a thin mucilaginous sheath.

Conidiophores upto 250 µm long, 6-10 µm thick. Conidia slightly curved or straight, broadly fusiform or obclavate fusiform, pale to golden brown, 4-11 distoseptate, 40-120 × 12-19 µm. The conidia are paler and narrower than those of *C. sativus.* The species is heterothallic.

On oats (*Avena*) and sometimes on other grasses. Australia, Europe, N. America (CMI. Distribution Map 267; Sivanesan, A. & Holliday, P., CMI Descr. 703, 1981).

C. tripogonis Alcorn, *Mycotaxon* **13:** 342, 1981.

Anamorph: *Drechslera tripogonis* A.S. Patil & V.G. Rao, *Trans. Br. mycol.Soc.* **59:** 340, 1972.

Bipolaris tripogonis (A.S. Patil & V.G. Rao) Alcorn, *Mycotaxon* **13:** 344, 1982.

Pseudothecia upto 150 μm broad with a very long neck. Asci 170-310 × 12.5-18.5 μm. Ascospores 4-7 septate, 175-275 × 4-6 μm.

Conidiophores mostly branched, arising from a fan-like pseudostroma, upto 300 μm long, 4-10 μm wide. Conidia cylindrical to fusiform, pale straw-coloured, 4-8 distoseptate, 60-130 × 13-23 μm, hilum 1-2 μm wide. The species is heterothallic.

On inflorescences of *Tripogon jacquemontei* and *T. loliiformis,* also on *Zea mays.* Australia, India.

C. stenospilus Matsumoto & W. Yamamoto was described in Japanese without a Latin description (*J.Pl. Prot.* **23:** 9-14, 107-115) and is therefore not validly published. It has *Drechslera stenospila* (Drechsler) Subram. & Jain as the anamorph (Ellis, 1976).

Recently Alcorn (1982) has described 4 new *Cochliobolus* species with their anamorphs in *Bipolaris* viz., *C. dactyloctenii (B. dactyloctenii*), *C. melinidis (B. melinidis), C. peregianensis (B. peregianensis)* and *C. perotidis (B. perotidis).* Alcorn (1983) in *Trans. Br. mycol. Soc.* **81:** 172, has also connected *D. ellisii* to *C. ellisii.*

CUCURBIDOTHIS Petrak, *Annls mycol.* **19:** 201, 1921.

The genus is monotypic but von Arx & Müller (1975) treat it as a synonym of *Curreya* Sacc. The type species of *Curreya, C. conorum* (Fuckel) Sacc. belongs to *Pleospora.*

C. pithyophila (Schmidt & Kunze) Petrak, *Annls mycol.* **19:** 201, 1921 (Fig. 220).

Sphaeria pithyophila Schmidt & Kunze: Fr., *Syst.mycol.* **2:** 425, 1823.
Cucurbitaria pithyophila (Schmidt & Kunze: Fr.) de Not., *Comm.Soc.Critt.Ital.* **1:** 214, 1863.
Melogramma spraguei Berk. & M.A.Curtis in Berk., *Grevillea* **4:** 99, 1876.
Thyridium spraguei (Berk. & M.A.Curtis) Sacc., *Syll.Fung.* **2:** 325, 1883.
Gibberidea pithyophila (Schmidt & Kunze: Fr.) von Arx, *Acta Bot.Neerl.* **3:** 90, 1954.
Curreya pithyophila (Schmidt & Kunze: Fr.) von Arx & E. Müller, *Stud.Mycol.* **9:** 80, 1975.

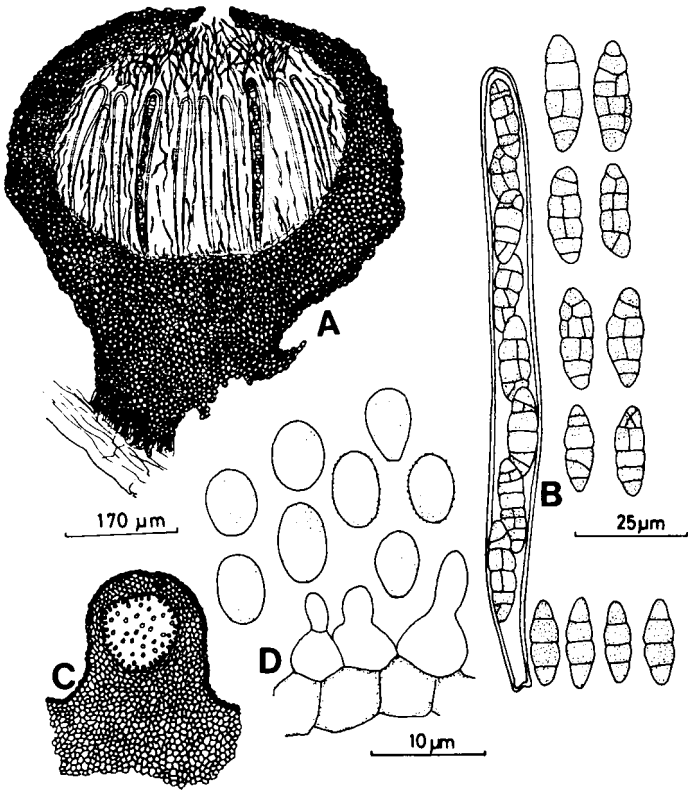


Fig. 220. *Cucurbidothis pithyophila.* A, v.s. ascostroma; B, ascus and ascospores; C, v.s. pycnidium; D, conidiogenous cells and conidia.

Anamorph: *Coniothyrium pithyophilum* (Höhnel) Petrak & H. Sydow, *Beih.Rep.spec.nov. regni veg.* **42:** 391, 1927.

Microsporella pithyophila Höhnel, *Hedwigia* **60:** 146, 1919.

Mycelium composed of dark brown, thick-walled, hyphal subiculum forming a scleroplectenchymatic, black, rather thin but hard, crust-like basal stroma. Stroma erumpent through the periderm, widely effused, black above and white below, up to 4 cm high and 0.3 mm wide, each containing dense clusters of unilocular ascocarps up to 700 µm wide with a broad, often slightly papillate and collapsing ostiole. The wall of the sterile stroma as well as that of the ascocarp is made up of hyaline, isodiametric, scleroplectenchymatic cells. The basal sterile, cylindrical part of the stroma is loosely prosenchymatous. The wall of the ascocarp up to 50 µm thick is composed of an outer layer of 2-3 layers of very thick-walled, dark brown, almost opaque cells and towards the inside the wall is made up of hyaline, thin-walled cells.

Asci 8 spored, 100-120 × 8-12 μm. Ascospores monostichous in the ascus, 3-5 transversely septate, with one incomplete vertical septum in some of the cells and oblique septum in the end cells, 16-25 × 7-9 μm, with pointed ends, brown. Pycnidia formed among the ascocarps are similar to ascocarps, stromatic, ostiolate, upto 500 μm wide, composed of dark brown, thick-walled, polygonal to irregular cells on the outside and thin-walled cells towards the inside. Conidiogenous cells formed from the inner cells lining the pycnidial cavity, holoblastic, annellidic, indeterminate, discrete, doliiform, hyaline, smooth, with 1-2 widely separated annellations. Conidia broadly ellipsoid, ovoid or globose, one celled, very pale olivaceous brown, punctiform, 5-7 × 3.5-5 μm with broadly rounded ends.

On *Pinus* spp. America, Europe.

This genus is separated from *Cucurbitaria* by the well-developed sclero-plectenchymatic wall.

Holm (1967) has described a variety, *C. pithyophila* var. *cembra* based on the type species of *Sphaeria parmeliarum* Phill. & Plowright which differs from *C. pithyophila* by phragmosporous ascospores.

CUCURBITARIA S.F.Gray, *Nat.Arr.Br.Pl.* **1:** 508, 519, 1821.

Crotonocarpia Fuckel, *Symb. mycol.:* 163, 1870.

Type sp.: *C. berberidis* (Pers.: Fr.) S.F. Gray, *Nat.Arr.Br.Pl.* **1:** 519, 1821.

Anamorphs: *Camarosporium* Schulzer, *Dichomera* Cooke, *Pyrenochaeta* de Not. and *Diplodia* Fr.

Pseudothecia small, black, clustered in groups on a basal hypostroma, subglobose, turbinate or almost flask-shaped, immersed, but always becoming fully or partly erumpent, with a rounded plane and minutely papillate apex which is ostiolate. Hypostroma subiculate or pseudoparenchymatous, scanty or well-developed, of fungal tissue or mixed with host tissue. Peridium smooth to rough, sometimes hairy, composed of dark brown angular to globose cells, often thickened at the base. Asci cylindrical, thick-walled, 2-8 spored, arising from a basal hymenium at different levels. Ascospores uniseriate or biseriate in the ascus, initially hyaline, later dark olivaceous brown to dark brown, ellipsoidal to broadly fusiform, dictyoseptate, constricted at the septa, with obtuse or acute ends. Pseudoparaphyses filamentous, hyaline, septate, branched. Saprophytes on dead branches.

Mirza (1968) has revised this genus; Welch (1926) has made a monographic study of this genus in North America and Müller & Baumeister (1957) have studied three species in culture.

Anamorphs: *Camarosporium* Schulz. Pycnidia immersed, globose, unilocular, dark brown to black, ostiolate. The wall composed of thick, dark brown, angular cells on the outside and paler thin-walled cells towards the interior. Conidiogenous cells holoblastic, annellidic, indeterminate, discrete, doliiform, lageniform or cylindrical, hyaline, smooth, formed from the inner cells lining the pycnidial cavity. Conidia brown to pale brown, dictyoseptate, smooth to verruculose, constricted or not at the transverse septa, with a truncate base and obtuse apex, variable in shape.

Dichomera Cooke: Pycnidia stromatic, multilocular, immersed to erumpent, ostiolate. The wall composed of thick-walled, dark brown cells externally and thin-walled, angular cells towards the interior. Conidiogenous cells simple, determinate or rarely indeterminate, similar as in *Camarosporium*. Conidia dictyoseptate, brown, variable in shape, smooth, constricted or not at the transverse septa, with a truncate base. This is a stromatic form of *Camarosporium*.

Pyrenochaeta de Not.: Pycnidia solitary to sometimes aggregated, globose, immersed to superficial, unilocular, brown, setose, ostiolate with a wall composed of pale brown cells. Conidiophores elongate, filiform, branched near the base, hyaline, septate, arising from the cells lining the pycnidial cavity. Conidiogenous cells enteroblastic, phialidic, determinate, integrated, as short lateral branches, hyaline, smooth, with a minute collarette and channel. Conidia hyaline, one celled, smooth, guttulate, cylindrical to ellipsoidal.

For a description of *Diplodia* Fr. anamorph see under *Pleospora*.

Key to Cucurbitaria species with anamorphs

Pseudothecia solitary or in groups of not more than five..... 1

Pseudothecia often in groups of more than five..... 8

1. Ascospores with 3-6 transverse septa, 20-32 × 9-13 μm..... *C. varians*

   Ascospores up to 9 transverse septa..... 2

2. Ascospores with 3-9 transverse septa..... 3

   Ascospores with 3-7 transverse septa..... 5

3. Ascospores with 5-9 transverse septa, 12-27 × 13-15 μm..... *C. ononidis*

   Ascospores with 3-8 transverse septa..... 4

4. Ascospores 26-31 × 10-12 μm, pseudothecia with prominent papillate ostiole..... *C. ribis*

   Ascospores 20-30 × 8-10 μm, ostiole rudimentary..... *C. ignavis*

5. Pseudothecia often compressed, ascospores 30-37 × 11-13 μm. *C. coluteae*

   Pseudothecia not compressed..... 6

6. Peridium prominently or minutely roughened..... 7

   Peridium smooth, ascospores 21-35 × 9-12 μm..... *C. spartii*

7. Peridium minutely roughened, ascospores 26-37 × 9-12 μm. *C. negundinis*

   Peridium prominently roughened, ascospores 22-32 × 9-13 μm..... *C. amorphae*

8. Ascospores up to 9 or more transversely septate..... 9

   Ascospores with less than 9 transverse septa..... 10

9. Ascospores with 4-9(12) transverse septa, 23-45 × 10-12 μm, pseudothecia with cracked rugose peridium..... *C. berberidis*

   Ascospores with 4-9 transverse septa, 22-40 × 9-11 μm, pseudothecia with elongate sterile base..... *C. laburni*

10. Ascospores with 3-8 transverse septa, 21-38 × 8-12 μm..... *C. elongata*

    Ascospores with up to 7 transverse septa..... 11

11. Ascospores with 3-6 transverse septa, 20-30 × 9-11 μm, pseudothecia hairy..... *C. dulcamarae*

    Ascospores with up to 7 transverse septa..... 12

12. Peridium smooth, ascospores 23-32(38) × 8-12 μm..... *C. caraganae*

    Peridium rough-walled..... 13

13. Peridium mostly thicker at the ostiolar region..... 14

    Peridium mostly thinner at the ostiolar region, ascospores 19-30 × 8-11 μm..... *C. ahmadii*

14. Peridium prominently rough-walled, ascospores 18-26 × 7.5-10 μm..... *C. cytisi*

    Peridium slightly rough-walled..... 15

15. Ascospores 16-27 × 6-9 μm..... *C. rhamni*

    Ascospores 19-27 × 9-12 μm..... *C. coronillae*

    Ascospores 19-32 × 9-11 μm..... *C. emeri*

    Ascospores 27-48 × 12-16 μm..... *C. staphula*

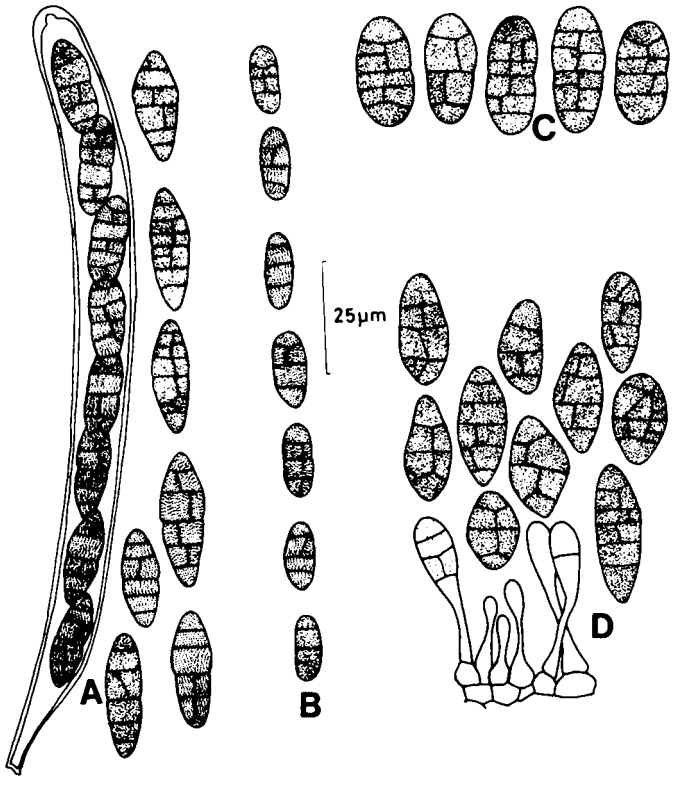


Fig. 221. *Cucurbitaria ahmadii* (type). A, ascus and ascospores; B, conidia. *C. varians*. C, ascospores; D, conidiogenous cells and conidia.

C. ahmadii Mirza, *Nova Hedwigia* **16:** 175, 1968 (Fig. 221A, B).

Anamorph: *Camarosporium* sp.

Hypostroma well-developed, composed of a subiculum of pale brown densely interwoven hyphae. Pseudothecia gregarious with elongate bases fusing completely to form a pseudoparenchymatous cushion, up to 415 µm broad, often in groups of five or more. Peridium with prominent rough surface, thinner at the ostiolar region. Asci long-stalked, 4-8 spored, 200-250 × 12-14 µm. Ascospores overlapping uniseriate or biseriate, 3-7 septate (mostly 3-5) with a complete or incomplete vertical septum, primary and secondary septa always dark, distinctly constricted at the medium septum, golden brown, paler-coloured at the subacute to obtuse ends, 19-30 × 8-11 µm.

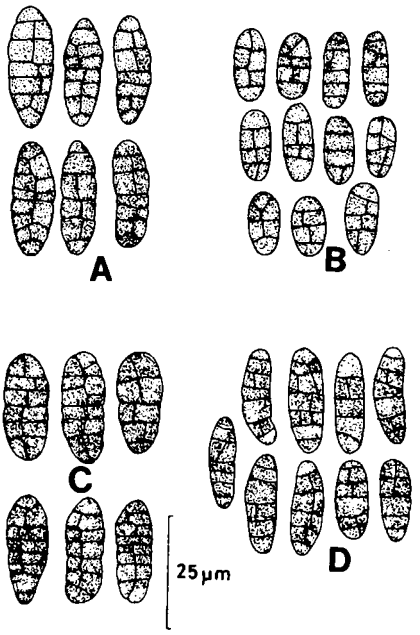


Fig. 222. *Cucurbitaria amorphae*. A, ascospores; B, conidia. *C. elongata*. C, ascospores; D, conidia.

Pycnidia formed in culture from single ascospore isolates (Mirza, 1968) up to 400 µm broad, ostiolate. Conidia brown to dark olivaceous brown, dictyoseptate, with 3 transverse septa which are sometimes oblique and one or no vertical septum, 11-18 × 5-8 µm.

On dead branches of *Caragana*. Pakistan.

C. amorphae (Wallr.) Fuckel, *Symb. mycol.*: 174, 1870 (Fig. 222A, B).

Sphaeria amorphae Wallr., *Fl.Crypt.Germ.* **2:** 781, 1833.
Sphaeria otagensis Lindsay, *Trans.Roy.Soc.Edinb.* **24:** 425, 1867.
Pleosphaeria otagensis (Lindsay) Sacc., *Syll. Fung.* **9:** 912, 1891.
Gibberidea amorphae (Wallr.) Kuntze, *Rev.Gen.Pl.* **3:** 481, 1898.

Hypostroma composed of a loosely reticulate dark brown subiculum. Pseudothecia gregarious in small groups of 2-5 or solitary, subglobose, sometimes turbinate, up to 520 µm broad. Peridium distinctly roughened and thickened near the ostiole. Asci short-stalked, 2-8 spored, 175-225 × 11-15 µm. Ascospores uniseriate, 5-7 (mostly 7) septate with mostly one complete or incomplete vertical septum, pale

golden brown, constricted at the septa but very distinctly in the middle, 22-32 × 9-13 μm.

No cultural studies have been done on this species but Saccardo (1883), Winter (1887) and Rostrup (1913) are of the opinion that *Diplodia amorphae* (Wallr.) Sacc. and *Camarosporium amorphae* Sacc. are the anamorphs of this species.

On dead branches of *Amorpha fruticosa* and *Sophora* spp. Central Europe.

C. berberidis (Pers.:Fr.) S.F. Gray, *Nat.Arr.Br.Pl.* **1:** 519, 1821 (Fig. 223).

Sphaeria berberidis Pers., *Syn.Meth.Fung.:* 52, 1801.
Sphaeria berberidis Pers.:Fr., *Syst.mycol.* **2:** 415, 1823.
Crotonocarpia moriformis Fuckel, *Symb. mycol.:* 163, 1870.
Gibberidea berberidis (Pers.) Kuntze, *Rev.Gen.Pl.* **3:** 481, 1898.
Cucurbitaria mahoniae Rich. f. *phellodendri* H. & P. Sydow, *Annls mycol.* **2:** 190, 1904.

Anamorph: *Pyrenochaeta berberidis* (Sacc.) Brun., *Liste Sphaerops:* 23, 1886.

Phoma berberidis Sacc., *Michelia* **1:** 259, 1878.
Pyrenochaeta berberidis Rich., *Cat. Champ.Marn.* No. 1630, 1889.

Hypostroma composed of a well-developed subiculum. Pseudothecia gregarious in groups, erumpent through ruptured bark, few to usually in large groups of more than eight, turbinate to subglobose with elongated bases, up to 650 μm broad. Peridium with an outermost prominently thick, black wall. Asci short-stalked, 2-8 spored, 160-275 × 17-21 μm. Ascospores pale to dark dull brown, 4-9 (sometimes up to 12) septate with up to 3 vertical septa, constricted at the primary septum, 23-45 × 10-12 μm.

Pycnidia found associated with pseudothecia as well as formed in culture from single ascospore isolations. (Brefeld & Tavel, 1891; Müller & Baumeister, 1957; Mirza, 1968).

Pycnidia ovoid to pyriform, ostiolate, up to 130 μm broad with abundant hairs. Conidia rod-shaped, hyaline, 3-4 × 0.75-1 μm, one celled, formed on septate conidiophores lining the cavity of the pycnidium.

According to Schneider (1979) this pycnidial anamorph is not a true *Pyrenochaeta*.

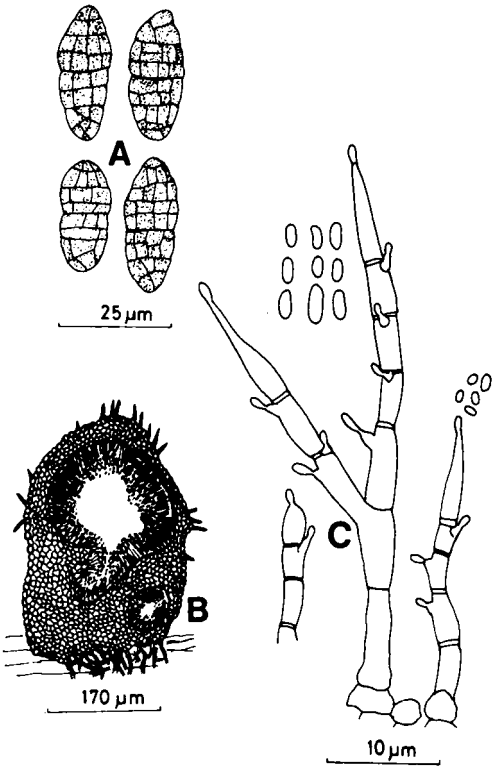


Fig. 223. *Cucurbitaria berberidis.* A, ascospores; B, v.s. pycnidium; C, conidiophores and conidia.

On dead branches of *Berberis* and *Phellodendron.* Asia, Europe, N. America.

C. caraganae P. Karsten, *Medd. Soc. Fenn.* **2:** 182, 1878 (Fig.224).

Gibberidea caraganae (P. Karsten) Kuntze, *Rev. Gen. Pl.* **3:** 481, 1898.

Hypostroma composed of a well-developed subiculum. Pseudothecia gregarious in large groups of more than five, erumpent through the bark, obovoid to turbinate, up to 650 µm broad. Peridium smooth, thicker near the base. Asci mostly short-stalked, 2-8 spored, 140-255 × 12-15 µm. Ascospores overlapping uniseriate, 5-7 (mostly 7) septate with 1 or 2 vertical septa, pale brown, constricted at the primary septum and less so in others, 23-32(38) × 8-12 µm.

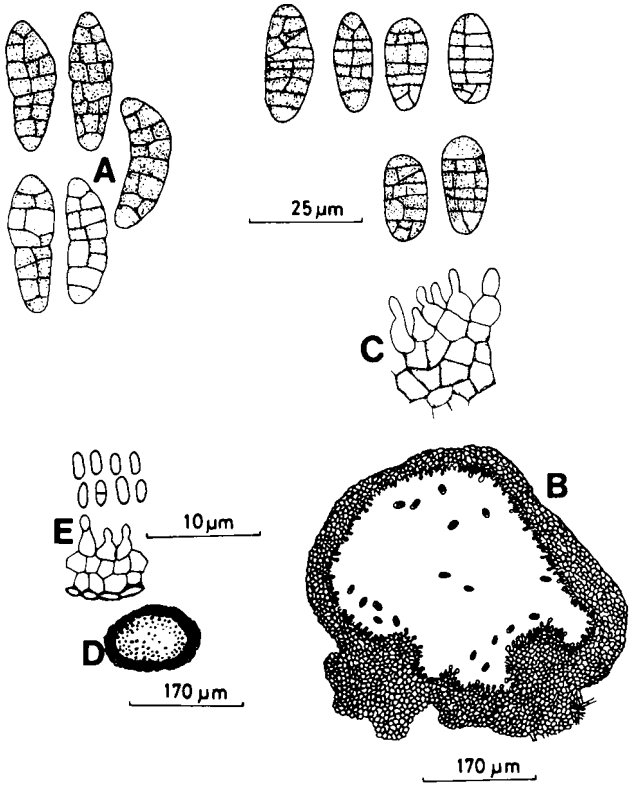


Fig. 224. *Cucurbitaria caraganae.* A, ascospores; B, v.s. pycnidium; C, conidiogenous cells and conidia; D-E, spermogonia and spermatia.

No cultural work has been done on this species but Winter (1887) and Rostrup (1913) report *Camarosporium caraganae* P. Karsten as the anamorph and Welch (1926) states *Pseudodichomera elaeagni* (P. Karsten) Höhnel as the possible anamorph.

On dead branches of *Caragana.* Europe and Siberia.

C. coluteae (Rabenh.) Auersw. in Fuckel, *Symb.mycol:* 174, 1870 (Fig. 225C,D).

Sphaeria coluteae Rabenh., Herb. Mycol. No. 1239, 1849.

Hypostroma composed of a poorly developed subiculum. Pseudothecia solitary or in groups of 2-5, erumpent, subglobose to often compressed,

up to 850 μm broad. Peridium more or less of uniform thickness. Asci short stalked 2-8 spored, 170-290 × 16-18 μm. Ascospores pale brown to dark olivaceous brown, uniseriate, 5-7(mostly 7) septate with 1-3 vertical septa, darker at the septa, constricted at the primary septum, 30-37 × 11-13 μm.

No cultural work has been done on this species. Rostrup (1913) and Winter (1903) report *Diplodia coluteae* Schnabl. as the pycnidial anamorph.

On dead branches of *Colutea arborescens*. Central Europe.

C. coronillae (Fr.) Thüm., *Mycotheca Univ.* No. 1259, 1876 (Fig. 225A,B).

Sphaeria coronillae Fr., *Syst.mycol.* **2:** 423, 1823.
Cucurbitaria elongata (Fr.) Grev. var. *coronillae* Fuckel, *Symb.mycol.*: 174, 1870.
Cucurbitaria coronillae (Fr.) Sacc., *Syll. Fung.* **2:** 312, 1883.

Anamorph: *Camarosporium* sp. (Mirza, 1968).

Hypostroma well developed to very much reduced, subiculate. Pseudothecia gregarious in large groups of more than five, up to 480 μm broad. Peridium slightly roughened on the surface, thickened towards the ostiolar region. Asci short stalked, sometimes long stalked, 2-8 spored, 150-220 × 11.5-15.5 μm. Ascospores uniseriate, 3-7 (mostly 5 or 7) septate with one vertical septum, pale to dark golden brown, prominently constricted at the primary septum, variable in form and shape, 19-27 × 9-12 μm.

Pycnidia formed in culture from ascospore isolates (Mirza, 1968), globose, hairy, ostiolate, up to 375 μm broad. Conidia golden brown, 3(5) septate with one vertical septum, not constricted at the septum, 10.5-15 × 4.5-6 μm.

On dead branches of *Coronilla emerus*. Central Europe.

C. cytisi Mirza, *Nova Hedwigia* **16:** 192, 1968.

Anamorph: *Camarosporium* sp.

Hypostroma mostly well-developed, subiculate. Pseudothecia gregarious in groups of 2-8, erumpent, sometimes fusing near the base, mostly turbinate to obovoid, upto 610 μm broad. Peridium prominently roughened, mostly thickened at the ostiolar region. Asci stalked, 2-8

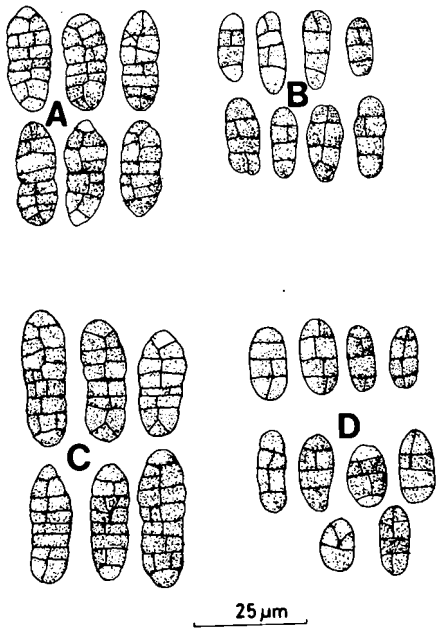


Fig. 225. *Cucurbitaria coronillae.* A, ascospores; B, conidia. *C. coluteae.* C, ascospores; D, conidia.

spored, 140-200 × 13-15.5 µm. Ascospores pale golden to dark golden brown, 3-7 (mostly 3-5) septate with 1 vertical septum, constricted at the septa, 18-26 × 7.5-10 µm.

Pycnidia produced in culture from single ascospore isolates (Mirza, 1968), subglobose to pyriform, ostiolate, upto 500 µm broad. Conidia pale to dark brown, 3 septate with 1 vertical septum, slightly constricted at the septa, 10.5-15 × 4.5-7 µm.

On dead branches of *Cytisus* and *Genista.* Central Europe.

C. dulcamarae (Kunze & Schmidt) Fr., *Summa veg. Scand.:* 39, 1849.

Sphaeria dulcamarae Kunze & Schmidt, *Mykol. Hefte* **1:** 62, 1817.
Sphaeria dulcamarae Kunze & Schmidt: Fr., *Syst.mycol.* **2:** 421, 1823.

Hypostroma well-developed, upto 525 µm broad. Peridium prominently roughened. Asci short stalked, 2-8 spored, 110-190 × 12-14 µm. Ascospores pale brown, 3-6 septate with mostly 1 or rarely 2 vertical septa, 20-30 × 9-11 µm. No cultural work has been done on this species. Win-

ter (1887) gives *Diplodia dulcamarae* Fuckel and a *Hendersonia*-like species as the anamorphs, while Rostrup (1913) mentions *D. dulcamarae* and *Hendersonia solani* P. Karsten as the anamorphs.

C. elongata (Fr.) Grev., *Scot. Crypt. Fl.* **4:** 195, 1826 (Fig. 222C,D).

Sphaeria elongata Fr., *Syst. mycol.* **2:** 422, 1823.

Anamorph: *Camarosporium* sp. (Mirza, 1968).

Hypostroma well developed, subiculate. Pseudothecia gregarious in large groups in longitudinal pustules, sometimes solitary, often in groups of six or more, erumpent, turbinate to obovoid, slightly elongated with conical bases, up to 775 μm broad. Peridium prominently roughened. Asci mostly short stalked sometimes long stalked, 2-8 spored, 140-255 × 14-18 μm. Ascospores dull brown, variable in shape and form, 3-8 (mostly 5 or 7) septate with 1-2 vertical septa, constricted at the septa more so in the middle, 21-38 × 8-12 μm.

Pycnidia formed in culture from ascospore isolates (Mirza, 1968), globose, hairy, ostiolate, up to 500 μm broad. Conidia oblong to somewhat ovoid, dull brown, 3-5 septate with one vertical septum in some of the end cells, not constricted at the septa, 13-21 × 7-10 μm.

On dead branches of *Robinia pseudacacia*. Central Europe and N. America.

C. emeri Mirza, *Nova Hedwigia* **16:** 191, 1968 (Fig. 226A,B).

Anamorph: *Diplodia* sp. (Mirza, 1968).

Hypostroma well developed, subiculate. Pseudothecia gregarious in large groups of more than five, up to 525 μm broad. Peridium slightly roughened at the surface, thickened at the ostiolar region. Asci short or long stalked, 2-8 spored, 150-220 × 11.5-15.5 μm. Ascospores uniseriate, golden brown, 3-7 septate with one vertical septum, constricted at the primary septum, and less so in others, variable in form and shape, 19-32 × 9-11 μm.

Pycnidia formed in culture from ascospore isolates (Mirza, 1968), embedded in a subiculate hypostroma, ostiolate, up to 600 μm broad. Conidia olivaceous brown, one septate, oblong with rounded ends, 18-23 × 7-9 μm.

On dead branches of *Coronilla emerus*. Central Europe.

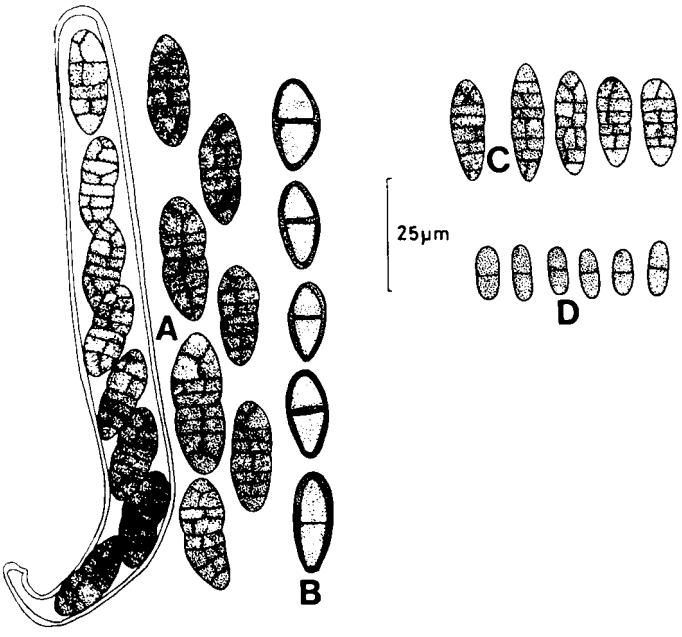


Fig. 226. *Cucurbitaria emeri* (type). A, ascus and ascospores; B, conidia. *C. rhamni*. C, ascospores; D, conidia.

C. ignavis de Not., *Sfer. Ital.:* 61, 1863 (Fig. 227).

Teichospora morthieri Fuckel, *Symb. mycol.:* 161, 1870.
Teichospora ignavis (de Not.) P. Karsten, *Mycol. Fenn.* **2:** 65, 1873.
Strickeria ignavis (de Not.) Winter, *Hedwigia* **10:** 175, 1880.

Anamorphs: *Camarosporium polymorphum* de Not. and *Leptophoma* sp. (Müller, 1962).

Hypostroma poorly developed, mostly thin, composed of parenchyma. Pseudothecia solitary, sometimes in groups of 2-4, erumpent, up to 700 µm broad, with a rudimentary papilla bearing ostiole. Peridium with rough surface. Asci short stalked, 8 spored, 120-160 × 16-18 µm. Ascospores uniseriate, brown, 6-8 septate with 1-2 vertical septa, constricted at the septa more so in the middle, 20-30 × 8-10 µm.

Two types of anamorphs were produced in culture from ascospore isolates (Müller, 1962). *Camarosporium* conidia 3(4) septate with one vertical septum, variable, pale to dark brown, 10-20 × 5-10 µm. *Leptophoma* conidia hyaline, 2-3 × 1 µm, one celled, formed on 10-

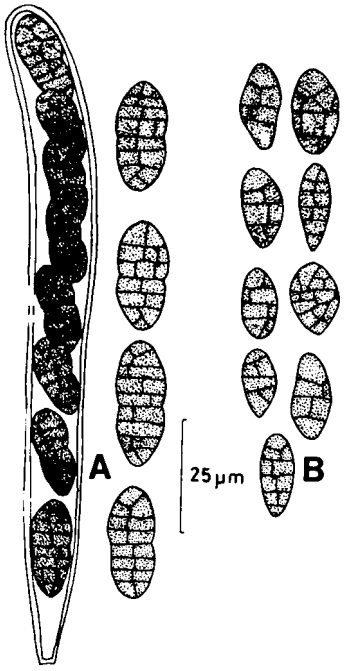


Fig. 227. *Cucurbitaria ignavis.* A, ascus and ascospores; B, conidia.

15 µm long, hyaline conidiophores lining the cavity of the pycnidium. According to Müller (1962) *Camarosporium xylostei* Sacc. and *C. caprifolii* Brun. are synonymous with *C. polymorphum.*

On dead branches of *Lonicera* and *Salix.* Central Europe and Pakistan.

C. laburni (Pers.: Fr.) de Not., *Exs. Erbar. Critt. Ital.* No. 875. 1862 (Fig. 228).

Sphaeria laburni Pers., *Syn. Fung.:* 50, 1801.
Sphaeria laburni Pers.: Fr., *Syst. mycol.* **2:** 413, 1823.
Gibberidea laburni (Pers.: Fr.) Kuntze, *Rev. Gen. Pl.* **3:** 481, 1898.

Anamorph: *Camarosporium* Mirza (1968).

Hypostroma very well developed, subiculate. Pseudothecia gregarious in large groups of five or more, erumpent, mostly turbinate, collapsing at the top to become flat, sometimes fusing, base very elongated, up to 950 µm broad. Peridium prominently roughened. Asci mostly

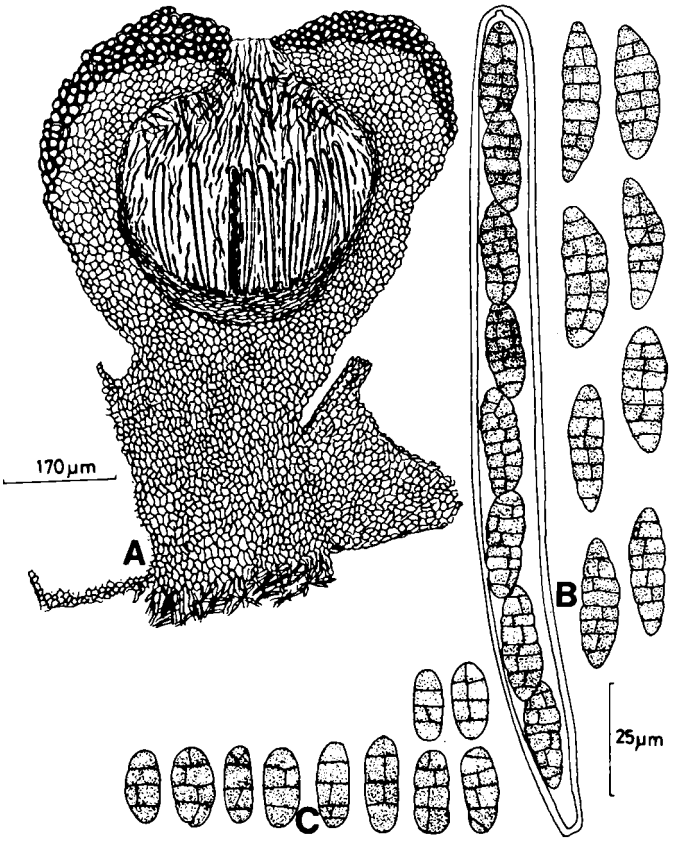


Fig. 228. *Cucurbitaria laburni.* A, v.s. pseudothecium; B, ascus and ascospores; C, conidia.

short stalked, rarely long stalked, 2-8 spored, 156-280 × 11-16 µm. Ascospores uniseriate, pale brown, 4-9 septate with 1-2 vertical septa, constricted at the septa more so in the middle, 22-32(40) × 9-11 µm.

On dead branches of *Laburnum* and *Cytisus*. Europe.

C. negundinis Winter in *Rabenh., Krypt.-Fl.* **1:** 329, 1887.

Hypostroma well developed, subiculate. Pseudothecia gregarious in small groups of 2-4, characteristically diffused on the surface, erumpent, collapsing at the top to become flat with a depressed ostiole, globose to subglobose, up to 500 µm broad. Peridium minutely rough-

ened at the surface. Asci short stalked, 6-8 spored, 160-200 × 13-20 μm. Ascospores obliquely uniseriate, pale to dark brown, 3-7 septate with one vertical septum, constricted at the septa more distinctly at the middle septum, variable in form and shape, 26-37 × 9-12 μm.

No cultural work has been done on this species but Berlese (1897), based on direct observation of herbarium specimen, reports *Camarosporium negundinis* Ell. & Ev. as the associated anamorph.

On dead branches of *Acer negundo*. Central Europe.

C. ononidis M. Massenot, *Rev. Mycol.* **29:** 82, 1962 (Fig. 229).

Hypostroma poorly developed, subiculate. Pseudothecia gregarious in small groups of 2-3, globose to subglobose, sometimes compressed, remaining under the bark, erumpent by ostiole only, up to 570 μm broad. Peridium with a slightly roughened surface. Asci short stalked, 4-8 spored, 184-242 × 15-18 μm. Ascospores uniseriate, brown, 5-9 septate with 1-3 vertical septa, constricted at the mid septum and slightly at the other septa, 12-27 × 13-15 μm.

Two types of anamorphs were found (Mirza, 1968) growing in association with the pseudothecia. *Camarosporium* anamorph with 2-7 septate conidia measuring 17-27 × 8-13 μm and an immature *Pyrenochaeta*-like anamorph.

On dead branches of *Ononis fruticosa*. Central Europe.

C. rhamni (Nees : Fr.) Fuckel, *Symb. mycol. :* 174, 1870 (Fig. 226C,D).

Sphaeria rhamni Nees, *Syst. Pilze :* 299, 1817.
Sphaeria rhamni Nees : Fr., *Syst. mycol.* **2:** 417, 1823.
Cucurbitaria rhamni Fr., *Summa Veg. Scand.:* 391, 1846.
Cucurbitaria moravica Rehm, *Annls. mycol.* **10:** 393, 1912.

Hypostroma well developed, subiculate. Pseudothecia gregarious in large groups of five or more, rarely solitary, subglobose to turbinate, up to 525 μm broad. Peridium with an irregularly roughened surface, more thickened towards the ostiolar region. Asci short stalked, rarely long stalked, 4-8 spored, 100-180 × 10-14 μm. Ascospores golden brown, 3-7 septate with 1-3 vertical septa, distinctly constricted at the mid septum and also in other septa, 16-27 × 6-9 μm.

No cultural work has been done on this species. *Camarosporium rhamni* Allesch. has been suggested by Rostrup (1913) and *Microdiplodia rhamni* Fuckel by Grove (1937) as the associated anamorphs.

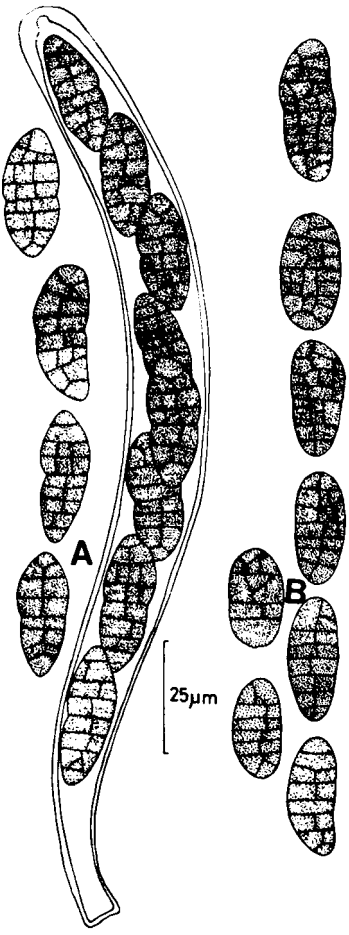


Fig. 229. *Cucurbitaria ononidis.* A, ascus and ascospores; B, conidia.

On dead branches of *Rhamnus* and *Alnus*. Central Europe.

C. ribis. (Fr.) Niessl, *Verh. Naturf. Brünn.* **10:** 98, 1871.

Sphaeria ribis Fr., *Syst. mycol.* **2:** 413, 1823.
Gibberidea ribis (Fr.) Kuntze, *Rev. Gen. Pl.* **3:** 481, 1898.

Hypostroma well developed, subiculate to plectenchymatous. Pseudothecia solitary or in groups of 2-3, subglobose to pyriform, up to 410 µm broad, with prominent papillate ostiole. Peridium rough with undu-

lating surface. Asci mostly stalked, 4-8 spored, 160-230 × 14-16 μm. Ascospores dark olivaceous brown, 3-8 septate, with 1-3 vertical septa, distinctly constricted at the mid septum and less so in others, 26-31 × 10-12 μm.

No cultural work has been done on this species but based on direct observation of herbarium specimens Rostrup (1913) and Grove (1937) believe *Diplodia ribis* Sacc. to be the associated anamorph.

On dead branches of *Ribes rubrum*. Europe, Pakistan.

S. spartii (Nees: Fr.) Ces. & de Not., *Comm. Soc. Critt. Ital.* **1:** 214, 1836.

Sphaeria spartii Nees : Fr., *Syst. mycol.* **2:** 424, 1823.
Gibberidea spartii (Nees: Fr.) Kuntze, *Rev. Gen. Pl.* **3:** 481, 1898.
Cucurbitaria spartii (Nees: Fr.) Ces. & de Not. f. *genistae tinctoriae* Fuckel, *Symb. mycol.* **2:** 32, 1873.

Hypostroma poorly developed, subiculate. Pseudothecia mostly solitary, also in groups of 2-4, erumpent, globose, up to 670 μm broad with a prominent short papillate ostiole. Peridium smooth uniformly thickened. Asci short stalked, 2-8 spored, 150-242 × 14-16 μm. Ascospores brown, 3-7 (mostly 7) septate with 1-2 vertical septa, constricted at the mid septum less so in others, 21-35 × 9-12 μm.

Mirza (1968) produced a *Pyrenochaeta*-like anamorph in culture from ascospore isolates. Pycnidia globose to oblong, up to 575 μm broad. Conidia hyaline, one celled, rod shaped, 4-6 × 1-2 μm formed on cylindrical, simple to rarely branched conidiophores.

On dead branches of *Sarothamnus, Genista* and *Cytisus*. Europe.

C. staphula Dearn. ex R. Arnold & Russell, *Mycologia* **52:** 501, 1961 (Fig. 230).

Anamorph: *Dichomera* sp.

Hypostroma thin. Pseudothecia turbinate to subglobose, gregarious in cracks in the bark, in large groups of five or more, crustose to zonate, united by a thin stromatic layer, up to 300 μm broad, ostiolate. Peridium roughened at the surface, more thickened towards the ostiole. Asci short stalked, 8 spored, 140-240 × 17-26 μm. Ascospores obovoid to pyriform, 3-7 septate with one or more vertical septa, constricted at all the septa but more prominently at the mid septum, 27-48 × 12-16 μm surrounded by a gelatinous sheath.

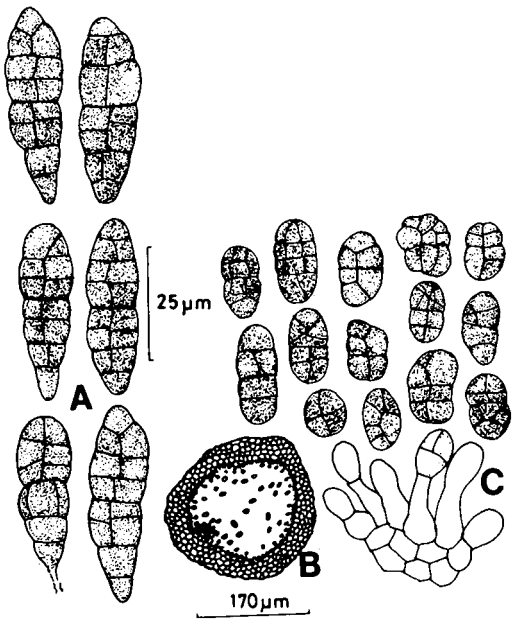


Fig. 230. *Cucurbitaria staphula* (type). A, ascospores; B, v.s. pycnidium; C, conidiogenous cells and conidia.

Pycnidial stroma mixed with pseudothecia, closely aggregated in concentric rings. Conidiophores simple, 3-10.5 × 3-5 µm, are short projections on cells lining the pycnidial cavity. Conidia borne singly on the tip of the conidiophore, dark brown, dictyoseptate with 1-3 septa and few vertical or oblique septa, subglobose to ovoid, 12-16 × 8-11 µm surrounded by a thin gelatinous sheath. Spermatia hyaline, allantoid or ovoid, 2 × 0.5 µm, one celled.

On galls and rough bark of *Populus tremuloides* and *P. balsamifera* caused by *Diplodia tumefaciens*. Canada. Zalasky (1964) reports two types of one celled microconidia formed in culture.

C. varians Hazsl., *Verh. Zool.-bot. Ges. Wien.* **15:** 451, 1865 (Fig.221C,D).

Dothidea lycii Duby in Rabenh., *Flora, Jena* **17:** 435, 1859.
Pleomassaria varians (Hazsl.) Winter in *Rabenh., Krypt.-Fl.* **2:** 552, 1887.

Hypostroma poorly developed, plectenchymatic. Pseudothecia solitary

or in groups of 2-3, never erumpent, globose to subglobose, with ostiole surrounded by hyaline cells, up to 800 μm broad. Peridium thickest near the ostiole. Asci short or long stalked, 6-8 spored, 180-230 × 11-18 μm. Ascospores golden brown, 3-6 septate with mostly one vertical septum, constricted at the septa, 20-32 × 9-13 μm.

No cultural work has been done on this species but there are conflicting reports of the associated anamorph in the literature. Hazslinsky (1865) mentions *Hendersonia* and *Coryneum,* Saccardo (1883) *Karstenula varians* (Hazsl.) Sacc., Winter (1887) *Sporidesmium lycii* Niessl, *Seimatosporium lycii* P. Karsten and *Staurosphaeria lycii* Rabenh., and Petrak (1924) *Diplodia* and *Camarosporium* as the anamorphs. All except Petrak's report can be discounted and the possibility of *Diplodia* and *Camarosporium* as the anamorph needs verification by cultural studies.

On dead branches *Lycium.* Europe.

DIDYMELLA Sacc., *Michelia* **2:** 57, 1880.

Arcangelia Sacc., *Bull.Soc.mycol.Fr.* **5:** 115, 1890.
Haplotheciella Hohnel, *Sber.Akad.Wiss.Wien* **128:** 614, 1919.
Didymolepta Munk, *Dansk bot.Ark.* **15:** 110, 1953.

Type sp.: *D. exigua* (Niessl) Sacc., *Michelia* **2:** 57, 1880.

Anamorphs: *Ascochyta* Lib., *Phloeospora* Wallr., *Phoma* Sacc. and *Stagonospora* (Sacc.) Sacc.

Pseudothecia scattered, immersed to erumpent, globose to subglobose, dark brown to black, with erumpent ostioles. The pseudothecial wall is composed of pseudoparenchymatous cells of equal thickness or is thickened above sometimes forming a clypeus. Asci short stalked, 8 spored, thickened above. Ascospores one septate, not or constricted at the septum, hyaline. Pseudoparaphyses filamentous, hyaline, usually branched, sometimes deliquescing at maturity.

Didymella species are highly specialized as regards their host range and are either saprophytic, parasitic or hyperparasitic on other fungi. Corbaz (1957) has studied some *Didymella* species in culture and descriptions of some species have been given by Müller & von Arx (1962) and Holm (1953).

Key to Didymella species with anamorphs

Ascospores septate in the middle or slightly submedianly septate

On Monocotyledons (Gramineae)

On *Hordeum and Triticum*

Ascospores 12-17 × 4-5.5 μm, *Ascochyta* conidia 15-18 × 3.5-4 μm..... ..... *D. exitialis*

On *Bromus, Echinochloa, Lolium, Melica* and *Phleum*

Ascospores 16-18 × 4-5 μm, *Ascochyta* conidia 18-24 × 5.5-8 μm *D. phleina*

On *Carex* and *Poa*

Ascospores 20-26 × 7.5-9 μm, *Stagonospora* conidia 20-34 × 6.5-9.5 μm.... ..... *D. proximella*

On *Lolium*

Ascospores 15-20 × 3-5 μm, *Ascochyta* conidia 14-20 × 3-4 μm..... ..... *D. graminicola*

On *Agropyron, Arrhenatherum, Bromus, Festuca, Phleum*

Ascospores 38-63 × 4.5-14 μm, *Phloeospora* conidia 18-105 × 3-9 μm..... ..... *D. festucae*

On Dicotyledons

On Asclepiadaceae, *Cynanchum* and *Vincetoxicum*

Ascospores 16-19 × 5.5-8 μm, *Ascochyta* conidia 10-19 × 3-6 μm..... ..... *D. vincetoxici*

On *Cannabidaceae, Cannabis*

Ascospores 16-22 × 4-6 μm, *Ascochyta* conidia 12-39 × 3-9 μm. *D. arcuata*

On Compositae, *Chrysanthemum* and *Pyrethrum*

Ascospores 12-16 × 4-7 μm, *Ascochyta* conidia 6-20 × 3-5 μm..... ..... *D. chrysanthemi*

On Cucurbitaceae, Cucurbits

Ascospores 14-18 × 6-7 μm, *Ascochyta* conidia 6-13 × 3-5 μm. *D. bryoniae*

On Leguminosae, *Phaca*

Ascospores 11-12 × 4-5 μm, *Ascochyta* conidia 7-10 × 2-4 μm... *D. phacae*

On Leguminosae, *Astragalus, Galegia, Melilotus* and *Ononis*

Ascospores 10-12 × 4-5 μm, *Ascochyta* conidia 4-11.5 × 2-4 μm... *D. nigra*

On Leguminosae, *Melilotus*

Ascospores 13-19 × 7-9 μm, *Ascochyta* conidia 10-17 × 3-5 μm.. *D. lethalis*

On Leguminosae, various legumes

Ascospores 8-18 × 4-8 μm, *Ascochyta* conida 8-19 × 3-5 μm.... *D. pinodes*

On Ranunculaceae, *Anemone*

Ascospores 15-22 × 5.5-7 μm, *Ascochyta* conida 13-22 × 4-5.5 μm..... ..... *D. vodakii*

On Ranunculaceae, *Clematis*

Ascospores 12-18 × 5.5-7.8 μm, *Ascochyta* conidia 5-7 × 3-3.5 μm..... ..... *D. vitalbina*

On Rosaceae, *Rosa, Rubus* and *Prunus*

Ascospores 13.5-18 × 5.5-7 μm, *Phoma* conidia 5-11 × 2-3.8 μm..... ..... *D. applanata*

On Sambucaceae, *Sambucus*

Ascospores 15-17 × 4.5-6 μm, *Phoma* conidia 5-10 × 2-7 μm..... *D. effusa*

On Solanaceae, *Lycopersicon* and *Solanum*

Ascospores 12-18 × 5-6 μm, *Phoma* conidia 5-10 × 2-3 μm.. *D. lycopersici*

On Urticaceae, *Urtica*

Ascospores 12-18 × 5.5-7.5 μm, *Phoma* conidia 3.4-8.5 × 2-3.5 μm..... ..... *D. urticicola*

On Valerianaceae, *Valeriana*

Ascospores 16-18 × 5-7 μm, *Phoma* conidia 4-11 × 2-3.5 μm.. *D. valeriana*

On various dicots

Ascospores 14-18 × 4.5-6 μm, *Phoma* conidia 9-13 × 4-6 μm.... *D. exigua*

Ascospores septate below the middle (anamorph in all cases is *Phoma*)

On *Leptosphaeria*

Ascospores 15-18 × 6-8 μm, conidia 11-18 × 3-5 μm..... *D. obstruens*

On Monocotyledons

On Gramineae, *Urtica*

Ascospores 18-21 × 6-8 μm, conidia 7-23 × 3-5 μm..... *D. eupyrena*

On Liliaceae, *Asphodelus*

Ascospores 16-19 × 5-6 μm, conidia 4-7 × 2 μm..... *D. asphodeli*

On Dicotyledons

On Leguminosae, *Lathyrus*

Ascospores 23-29 × 10-11.5 μm, conidia 8-20 × 2-5 μm.... *D. macrospora*

On Leguminosae, *Medicago* and *Trifolium*

Ascospores 15-17 × 5-6.5 μm, conidia 4-11 × 2-3 μm..... *D. trifolii*

On Ranunculaceae, *Aconitum*

Ascospores 15-19 × 6-7 μm, conidia 10-16 × 4-5 μm..... *D. inaequalis*

On Scrophulariaceae, *Pedicularis*

Ascospores 17-26 × 5-9 μm, conidia 6-16 × 3-5 μm..... *D. pedicularidis*

On Scrophulariaceae, *Rhinanthus*

Ascospores 16-19 × 5-7.5 μm, conidia 5-7 × 2-3 μm..... *D. alectorolophi*

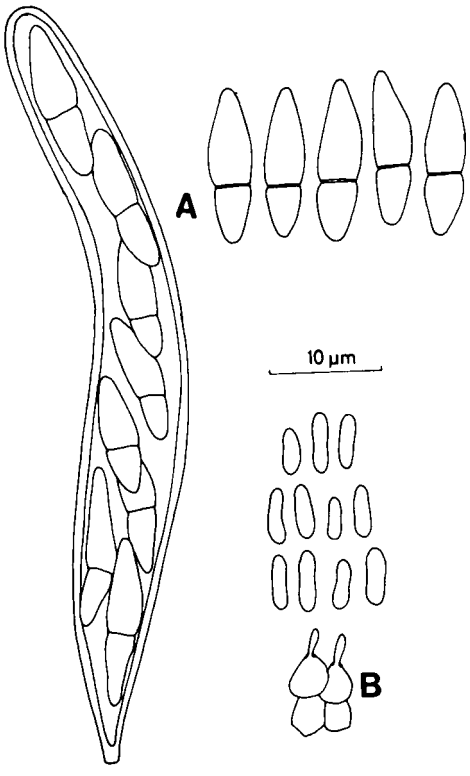


Fig. 231. *Didymella alectorolophi*. A, ascus and ascospores; B, conidiogenous cells and conidia.

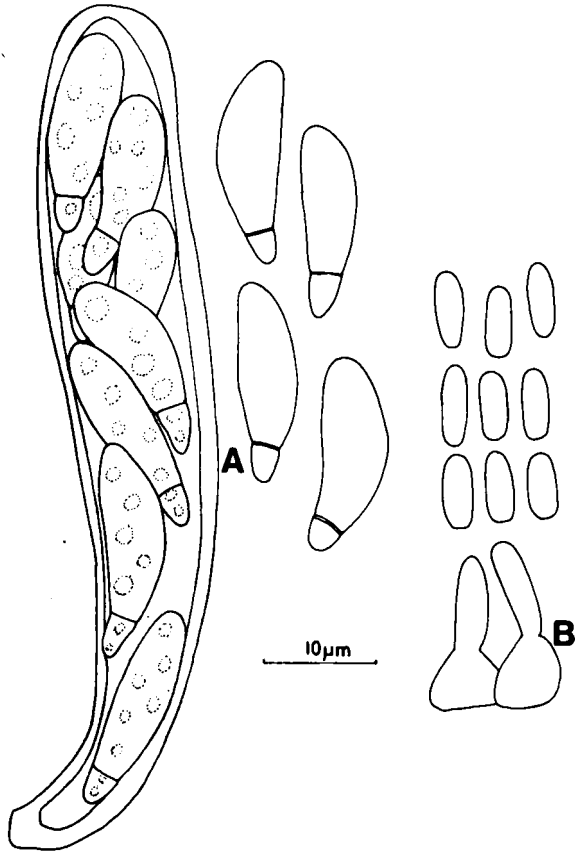


Fig. 232. *Didymella asphodeli* (type). A, ascus and ascospores; B, conidiogenous cells and conidia.

Ascospores septate below the middle

D. alectorolophi Rehm, *Hedwigia* **64:** 294, 1923 (Fig. 231).

Didymella ruttneri Petrak, *Sydowia* **9:** 574, 1955.

Pseudothecia up to 350 µm broad. Asci cylindrical, 55-65 × 8-10 µm. Ascospores 16-19 × 5-7.5 µm.

Pycnidia formed in culture from ascospore isolates (Corbaz, 1957), up to 300 µm broad. Conidia one celled, hyaline, rod-shaped, 5-7 × 2-3 µm.

On dead twigs of *Rhinanthus alectorolophus*. Europe.

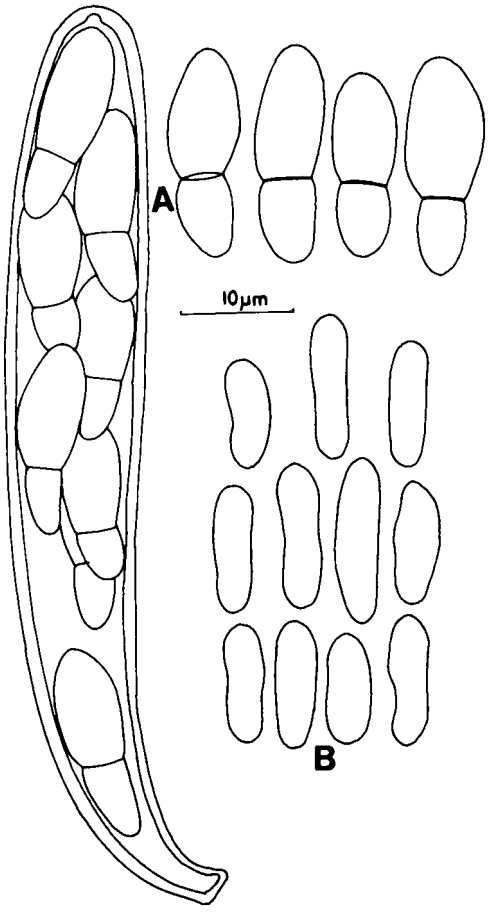


Fig. 233. *Didymella inaequalis* (type). A, ascus and ascospores; B, conidia.

D. asphodeli E. Müller, *Sydowia* **12:** 245, 1958 (Fig. 232).

Pseudothecia up to 180 µm broad. Asci cylindric-clavate, 90-100 × 12-14 µm. Ascospores clavate fusoid, mostly curved, 16-19 × 5-6 µm.

Müller (1958) reports *Phyllostictina solieri* (Mont.) Petrak & Sydow and *Phoma asphodelina* Thüm. as the associated anamorphs with 4-7 × 2 µm conidia.

On dead branches of *Asphodelus albus*. Switzerland.

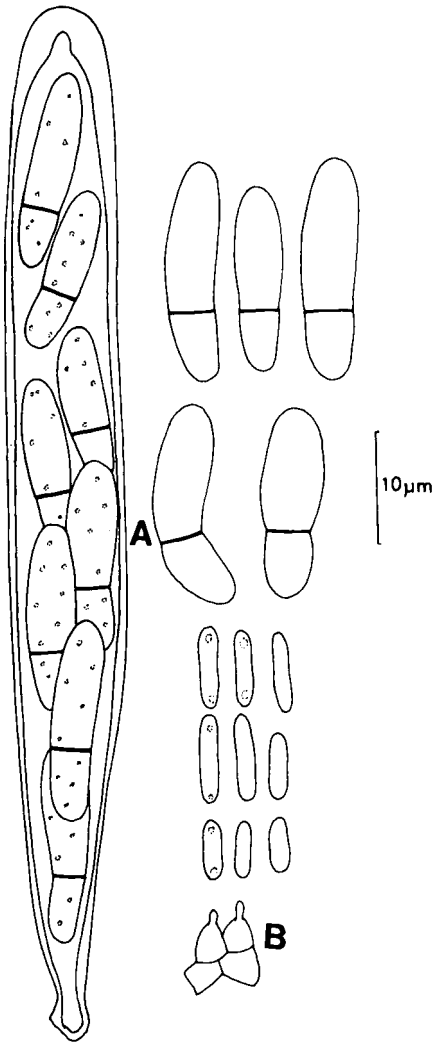


Fig. 234. *Didymella eupyrena*. A, ascus and ascospores; B, conidiogenous cells and conidia.

D. inaequalis Corbaz, *Phytopath. Z.* **28:** 399, 1957 (Fig. 233).

Pseudothecia solitary to aggregated, up to 280 µm broad. Asci cylindrical, 65-75 × 11-13 µm. Ascospores 15-19 × 6-7 µm.

Pycnidia mixed with pseudothecia and produced in culture from ascospore isolations (Corbaz, 1957) up to 200 µm broad. Conidia hyaline,

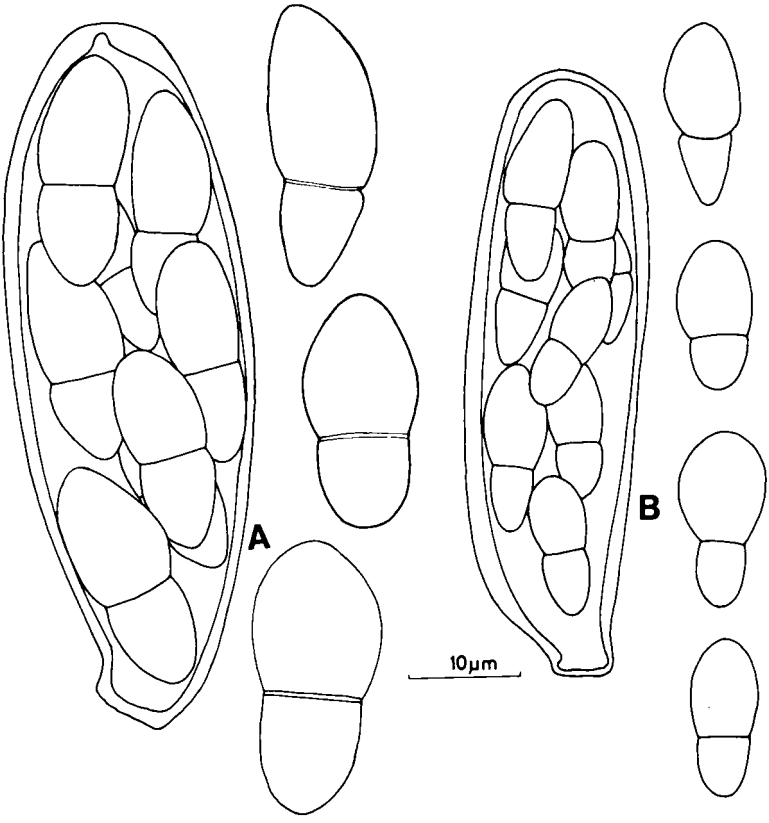


Fig. 235. *Didymella macrospora* (type). A, ascus and ascospores. *D. obstruens* (type). B, ascus and ascospores.

one celled, 11-13 × 4-5 µm, in culture 10-11 × 4-5 µm when one celled, 10-16 × 4-5 µm when two celled.

On dead twigs of *Aconitum lycoctonum*. France.

D. eupyrena Sacc., *Michelia* **2:** 161, 1880 (Fig. 234).

Didymella superflua (Auersw.) Sacc. var. *macedonica* Petrak, *Annls. mycol.* **34:** 212, 1936.

Pseudothecia solitary or aggregated up to 230 µm broad. Asci cylindrical, 70-85 × 9-12 µm. Ascospores 18-21 × 6-8 µm.

Pycnidia produced in culture (Corbaz, 1957). Conidia hyaline, cylindrical to rod shaped, 0-1 septate, 7-23 × 3-5 µm.

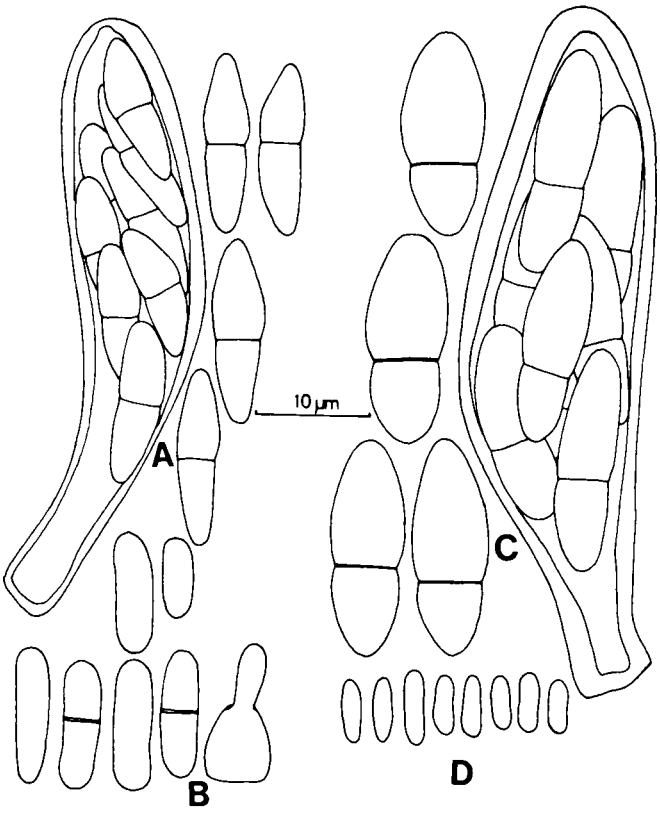


Fig. 236. *Didymella exigua.* A, ascus and ascospores; B, conidiogenous cell and conidia. *D. pedicularidis* (type). C, ascus and ascospores, D, conidia.

On dead stems of *Urtica dioica.* Europe.

D. macrospora Corbaz, *Phytopath. Z.* **28:** 405, 1957 (Fig. 235A).

Pseudothecia mostly solitary, rarely in pairs, up to 230 µm broad. Asci cylindrical, 70-90 × 22-24 µm. Ascospores 23-29 × 10-11.5 µm.

Pycnidia formed in culture from ascospore isolates (Corbaz, 1957). Conidia 0-1 septate, ovoid, rod shaped, cylindrical or elliptical, 8-20 × 2-5 µm.

On *Lathyrus latifolius.* France.

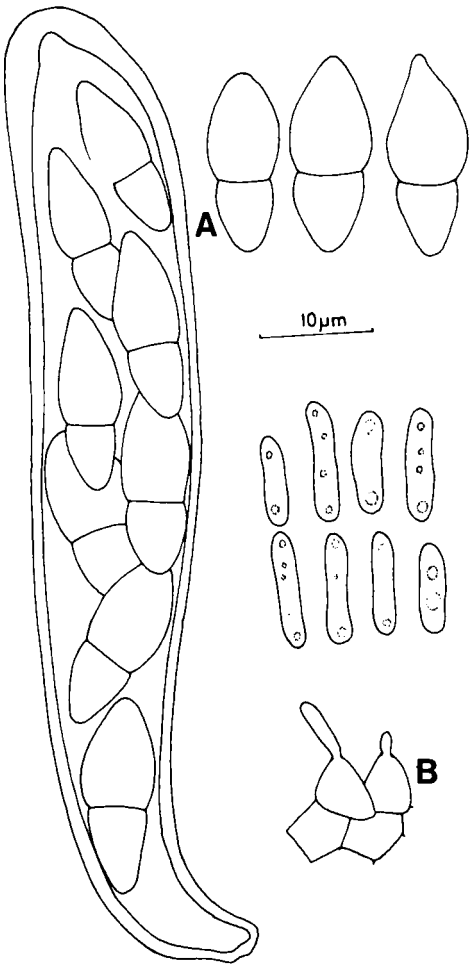


Fig. 237. *Didymella trifolii.* A, ascus and ascospores; B, conidiogenous cells and conidia.

D. obstruens Corbaz, *Phytopath. Z.* **28:** 406, 1957 (Fig. 235B).

Pseudothecia parasitic on fruit bodies of *Leptosphaeria punctoidea* P. Karsten up to 170 µm broad. Asci cylindrical, 55-70 × 11.5-14 µm. Ascospores fusoid, 15-18 × 6-8 µm.

Pycnidia formed in culture (Corbaz, 1957) up to 300 µm broad with a cylindrical ostiolate neck. Conidia hyaline, one celled, rod shaped to ovoid, sometimes irregular, guttulate, 11-18 × 3-5 µm.

On dead stems of *Lathyrus silvester* colonized by *Leptosphaeria punctoidea*. France.

D. pedicularidis von Arx, *Sydowia* **4:** 389, 1950 (Fig. 236C,D).

Pseudothecia solitary to somewhat aggregated, up to 250 μm broad. Asci cylindrical, 60-100 × 11-16 μm. Ascospores fusoid, 17-26 × 5-9 μm.

Pycnidia mixed with pseudothecia. Conidia hyaline, one celled, 6-9 × 2-4 μm. In isolates from ascospores, conidia are 0-1 septate and measure 6-16 × 3-5 μm.

According to von Arx (*loc. cit.)* the pycnidial anamorph belongs to *Plenodomus prominens* (Bres.) Petrak (= *Phoma prominens* Bres., *Plenodomus helveticus* Petrak).

On stems of *Pedicularis foliosa, P. kerneri*. Switzerland.

D. trifolii (Fuckel) Sacc., *Syll. Fung.* **1:** 554, 1882 (Fig. 237).

Sphaeria trifolii Fuckel, *Symb. Mycol.:* 112, 1870.

Pseudothecia solitary or aggregated, up to 250 μm broad. Asci cylindrical, 50-60 × 11-12 μm. Ascospores 15-17 × 5-6.5 μm.

Phoma anamorph formed in culture (Corbaz, 1957) as well as mixed with pseudothecia in natural substrata. Conidia hyaline, one celled, somewhat rod shaped, 4-11 × 2-3 μm.

On stems of *Medicago sativa, Trifolium pratense*. Europe.

Ascospores septate in the middle or slightly submedianly septate

D. arcuata Röder, *Phytopath. Z.* **12:** 321, 1939.

Anamorph: *Ascochyta cannabis* Lasch in *Kl. Herb. Mycol. ed. 1.* 1059, 1846.

Septoria cannabis (Lasch) Sacc., *Syll. Fung.* **3:** 557, 1884.

Pseudothecia up to 150 μm broad. Asci 57-60 × 10-13 μm. Ascospores septate in the middle, 16-22 × 4-6 μm.

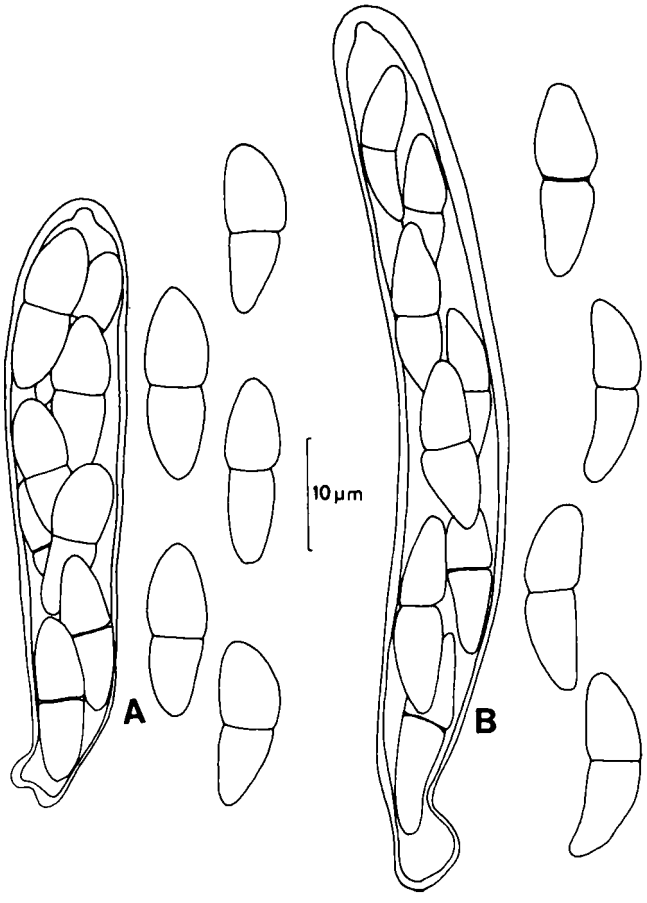


Fig. 238. *Didymella applanata* (type). A, ascus and ascospores. *D. effusa*. B, ascus and ascospores.

Pycnidia formed in culture from conidial and ascospore isolates as well as found mixed with pseudothecia on natural substrata, up to 150 µm broad. Conidia oblong ellipsoidal, 1-2 septate, hyaline, 12-39 × 3-9 µm. Chlamydospores sometimes formed in culture.

On leaves of *Cannabis sativa*. Germany.

D. applanata (Niessl) Sacc., *Syll. Fung.* **1:** 546, 1882 (Fig. 238A).

Didymosphaeria applanata Niessl, *Oster. Bot. Ztschr.* **25:** 129, 1875.
Sphaerella rubina Peck, *Rep. N.Y. St. Mus.* **48:** 114. 1892.
Mycosphaerella rubina (Peck) House, *Bull. N.Y. St. Mus.* **233-234:** 30, 1921.

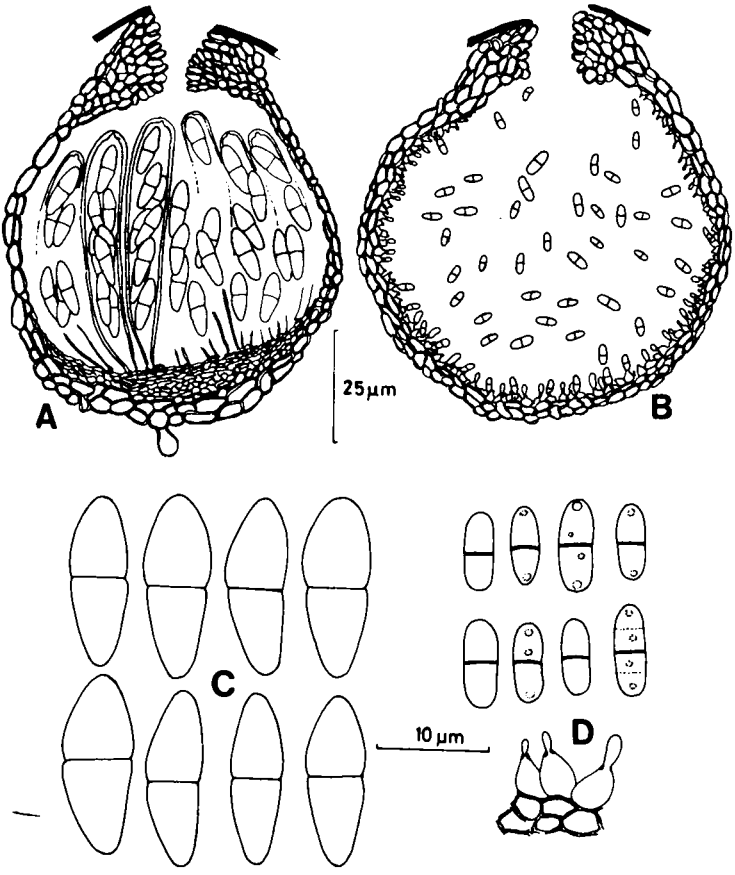


Fig. 239. *Didymella bryóniae*. A, v.s. pseudothecium; B, ascus and ascospores; C, v.s. pycnidium; D, conidiogenous cells and conidia.

Anamorph: *Phoma* sp.

Pseudothecia gregarious up to 225 µm broad. Asci 50-65 × 10-13 µm. Ascospores septate in the middle, sometimes inequilateral, upper cell wider, constricted at the septum, 13.5-18 × 5.5-7 µm.

Pycnidia present on natural substrata as well as formed in culture, up to 260 µm broad. Conidia hyaline, ovoid to ellipsoidal, one celled biguttulate, in culture 5.5-6.5 × 2.5-3 µm, on host 5-11 × 2-3.8 µm.

On stems, leaves and buds of *Rubus idaeus*. Causes spur blight.

D. bryoniae (Auersw.) Rehm, *Ber. d. Naturhist. Ver. in Augsburg* **26:** 27, 1881 (Fig. 239).

Sphaerella bryoniae Auersw. in Gonnerm. & Rabenh., *Mycol. Europ.* **5:** 15, 1869.
Sphaeria bryoniae Fuckel, *Symb. mycol.:* 112, 1870.
Didymosphaeria bryoniae (Auersw.) Niessl, *Osterr. Bot. Zschr.* **25:** 130, 1875.
Mycosphaerella citrullina Grossenb., *N. Y. Agr. Expt. Sta. Tech. Bull.* **9:** 229, 1909.
Didymella melonis Pass., *Syll. Fung.* **9:** 662, 1891.
Mycosphaerella melonis (Pass.) Chiu & Walker, *J. agric. Res.* **78:** 81, 1949. (as *M. cucumis* (Fautr. & Roum.) Chiu & Walker)
Sphaerella melonis Ferraris, *Annls. mycol.* **10:** 286, 1912.

Anamorph: *Ascochyta cucumis* Fautr. & Roum., *Rev. mycol.* **13:** 73, 1891.

Phyllosticta citrullina F. Chester, *Bull. Torrey bot. Club* **18:** 374, 1891.
Ascochyta citrullina (F. Chester) C. Smith, *Bull. Delaware Exp. St.* **70:** 1-16, 1905.
Diplodina citrullina (C.Smith) Grossenb., *Techn. Bull. N.Y. Agric. Exp. Stn.* **9:** 226, 1909.
Ascochyta melonis Potebnia, *Annls. mycol.* **8:** 63, 1910.

Pseudothecia up to 200 μm broad. Asci cylindrical to cylindric-clavate, short stalked, 8 spored, 60-90 × 10-15 μm. Ascospores ellipsoid, slightly constricted at the septum, 14-18 × 6-7 μm. Pycnidia solitary to gregarious, globose, immersed to erumpent, dark brown, up to 180 μm broad. Conidia hyaline, shortly cylindrical with rounded ends, guttulate, 0-mostly 1 septate, 6-13 × 3-5 μm.

On stems, leaves and fruits of Cucurbits causing gummy stem blight showing a variety of symptoms referred to as leaf spot, stem canker, vine wilt and black fruit rot. Widespread.

D. chrysanthemi (Tassi) Garibaldi & Gullino, *L'Agricoltura Ital.* **71:** 286, 1971 (Fig. 240A,B).

Sphaerella chrysanthemi Tassi, *Bull. Lab. Orto Bot. Univ. Siena* **3:** 117, 1900.
Mycosphaerella ligulicola Baker, Dimock & Davis, *Phytopathology* **39:** 99, 1949.
Didymella ligulicola (Baker, Dimock & Davis) von Arx in Müller & von Arx, *Beitr. Kryptogamenfl. Schweiz* **11:** 364, 1962.

Mycosphaerella chrysanthemi (Tassi) Tomilin, *Opredelitel gribov roda Mycosphaerella Johans.:* 60, 1979.

Anamorph: *Ascochyta chrysanthemi* F. Stev., *Bot. Gaz.* **44:** 246, 1907.

Phoma chrysanthemi Vogl., *Malpighia* **15:** 332, 1902.

Pseudothecia on greyish spots on old stems, leaves and petals, erumpent, upto 225 μm diam., with a papillate ostiole. Asci 45-90 × 8-12 μm. Ascospores hyaline, fusoid, constricted at the septum, guttulate, 12-16 × 4-7 μm.

Pycnidia immersed to erumpent, mostly on stems and petals, depressed globose, ostiolate, scattered, upto 300 μm diam. Conidia oblong ellipsoid to ovoid, straight or somewhat curved, hyaline, 6-10(20) × 3-5 μm, with acute or obtuse ends.

On *Chrysanthemum* causing 'ray blight' disease. Europe, U.S.A. Punithalingam (1980b) has given an account of the morphology, symptoms and disease of this species. The life history of this fungus has been described by Baker et al (1949) and Stevens (1907). According to Walker & Baker (*Trans. Br. mycol. Soc.* **80:** 38, 1983) the correct binomial for the ray blight pathogen is *Didymella ligulicola*, and *D. chrysanthemi* is a species of *Mycosphaerella*.

D. effusa (Niessl) Sacc., *Syll. Fung.* **1:** 552, 1882 (Fig. 238B).

Didymosphaeria effusa Niessl, *Neue Kernp.:* 130, 1875.
Didymella sambucina Feltg., *Vorstud.Pilz.Luxemb.Nachtr.* **3:** 252, 1903.

Pseudothecia up to 180 μm broad, subepidermal. Asci 45-60 × 11-13 μm. Ascospores 15-17 × 4.5-6 μm.

Pycnidia formed in culture from ascospore isolates (Corbaz, 1957). Conidia ovoid to rod shaped, 0-1 septate, hyaline, 5-10 × 2-7 μm.

On branches of *Sambucus ebulus*. Europe.

D. exigua (Niessl) Sacc., *Michelia* **2:** 57, 1880. (Fig. 236A,B).

Didymosphaeria exigua Niessl, *Oestr. Bot. Ztschr.* **25:** 165, 1875.

Pseudothecia up to 140 μm broad, subepidermal. Asci 45-50 × 10-12 μm. Ascospores 14-18 × 4.5-6 μm.

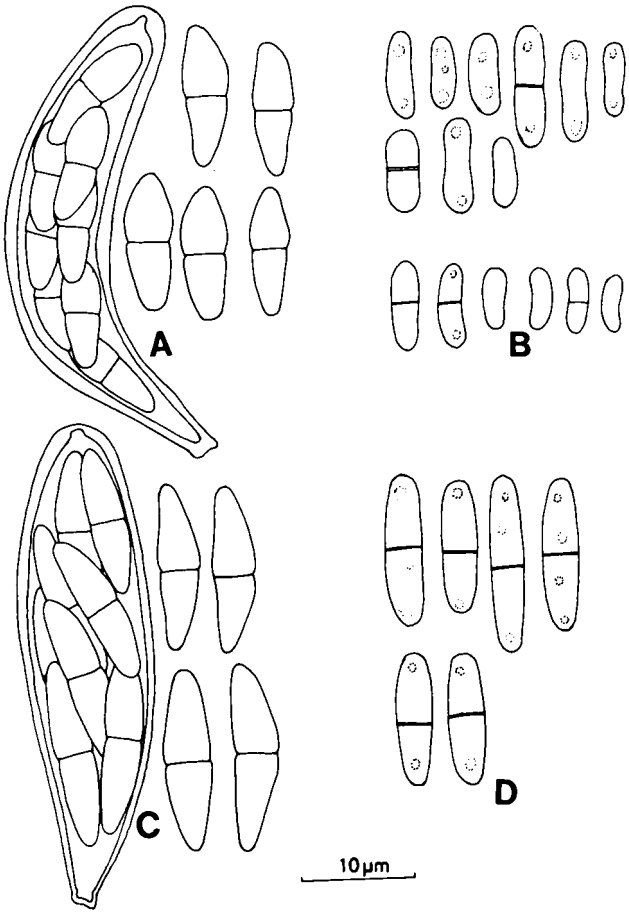


Fig. 240. *Didymella chrysanthemi.* A, ascus and ascospores; B, conidia. *D. exitialis.* C, ascus and ascospores; D, conidia.

Pycnidia mixed with pseudothecia on host as well as produced in culture from ascospore isolates (Corbaz, 1957), up to 140 µm broad. Conidia hyaline, cylindrical to rod shaped, one celled, rarely 1 septate, 9-13 × 4-6 µm.

On stems of *Atropa belladonna, Dipsacus* spp., *Hypericum androsacum, Melittis melissophyllum, Rumex acetosa, R. arifolius, Scrophularia nodosa, Stenactis annua, Verbena officinalis.* Europe.

D. exitialis (Morini) E. Müller, *Phytopath. Z.* **19:** 407, 1952 (Fig. 240C,D).

Sphaerella exitialis Morini, *Nuovo G. bot. Ital.* **18:** 37, 1886.

Anamorph: *Ascochyta* sp.

Pseudothecia up to 130 μm broad. Asci 40-60 × 8-12 μm. Ascospores ellipsoidal to somewhat biconic, nearly septate in the middle, 12-17 × 4-5.5 μm.

Pycnidia immersed, up to 120 μm broad. Conidia hyaline, ellipsoidal, guttulate, 1 septate, 15-18 × 3.5-4 μm formed on hyaline, phialidic, somewhat doliiform conidiogenous cells lining the cavity of the pycnidium.

On *Hordeum vulgare* and *Triticum aestivum*. Causes leaf scorch. Ethiopia, Great Britain,? India, Switzerland, Turkey.

D. festucae (Wegelin) Holm, *Svenska Bot. Tidskr.* **47:** 522, 1953 (Fig. 241).

Didymosphaeria festucae Wegelin, *Mitt. thurgau. naturf. Ges.* **12:** 2, 1896.

Anamorph: *Phloeospora idahoensis* Sprague, *Mycologia* **40:** 180, 1948.

Pseudothecia subepidermal, up to 500 μm broad. Asci cylindric-clavate, 50-150 × 15-27 μm. Ascospores fusoid septate above the middle, 38-63 × 4.5-14 μm.

Pycnidia immersed, up to 150 μm broad. Conidia hyaline, usually curved, pointed at the apex, truncate at the base with an inconspicuous scar, mostly one celled, guttulate, 18-105 × 3-9 μm, rarely becoming 1-3 septate on germination.

Pseudothecia on culms, sheaths and inflorescences as linear eye spots, pycnidia on stems as dark blisters. On *Agropyron, Bromus, Festuca, Phleum*. Canada, S. America (Smith, 1971; Smith & Shoemaker, 1974).

D. graminicola Punith., *Mycol. Pap.* **119:** 2, 1969 (Fig. 242C,D).

Anamorph: *Ascochyta* sp.

Pseudothecia up to 200 μm broad. Asci cylindrical to subclavate, 40-50 × 10-12 μm. Ascospores ovoid to elliptical, 15-20 × 3-5 μm, constricted at the septum, upper cells slightly larger than the lower cell.

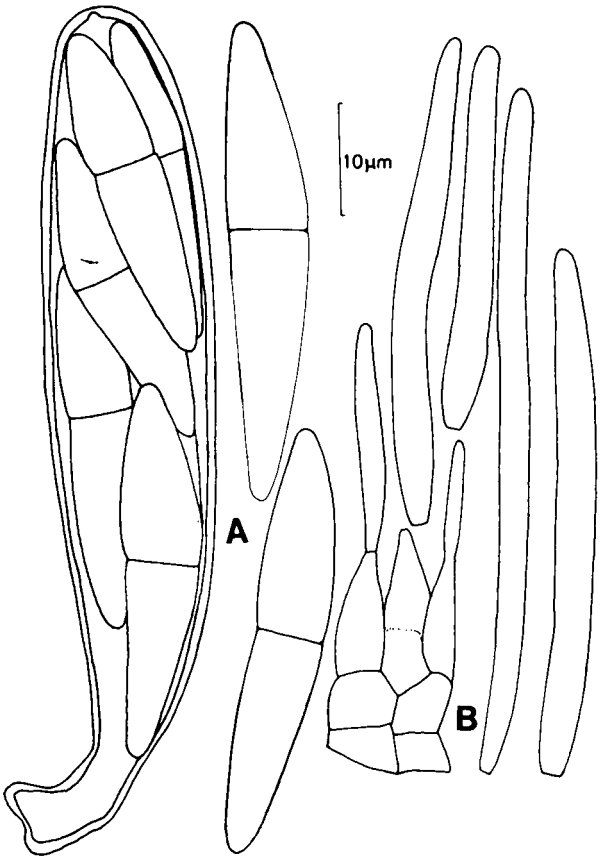


Fig. 241. *Didymella festucae.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Pycnidia up to 180 µm broad, ostiolate. Conidia (phialospore) hyaline, straight, sometimes curved, cylindrical to ovate, 1 septate, not constricted at the septum, ends obtuse, 14-20 × 3-4 µm, formed on short obpyriform conidiogenous cells, 6-10 × 6-8 µm, arising from undifferentiated cells lining the inside of the pycnidium.

Isolated from *Lolium* seeds (*L. perenne* and *L. multiflorum).* W. Germany.

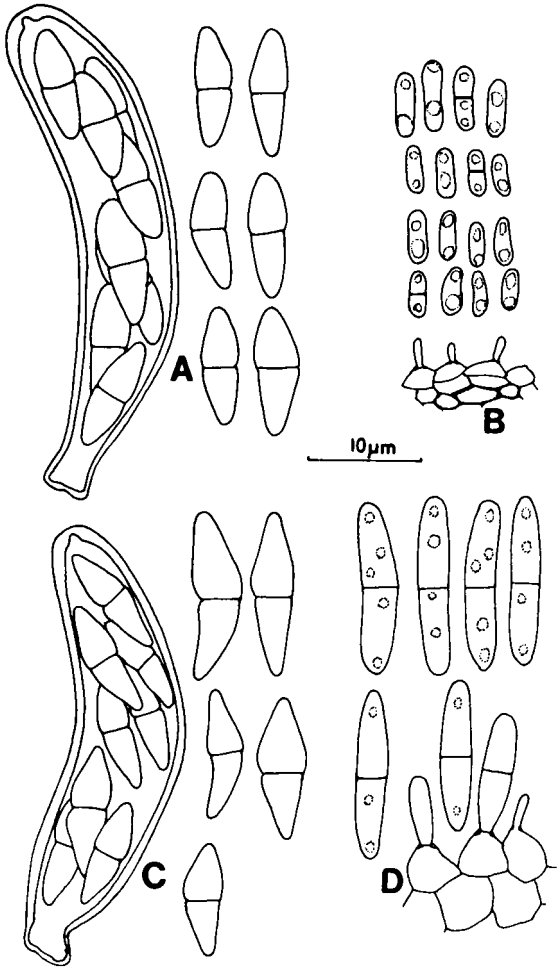


Fig. 242. *Didymella lycopersici.* A, ascus and ascospores; B, conidiogenous cells and conidia. *D. graminicola.* C, ascus and ascospores; D, conidiogenous cells and conidia.

D. lethalis (R. Stone) comb. nov. (Fig. 243).

Mycosphaerella lethalis R. Stone, *Annls mycol.* **10:** 587, 1912.

Anamorph: *Ascochyta lethalis* Ell. & Barth. in Barth., *Fungi Columbiani* No. 1808, 1903.

Ascochyta meliloti (Trelease) J. Davies, *Trans. Wisc. Acad.* **19:** 663, 1919. *Gloeosporium (Marsonia) meliloti* Trelease, *Trans. Wisc. Acad.* **6:** 120, 1885.

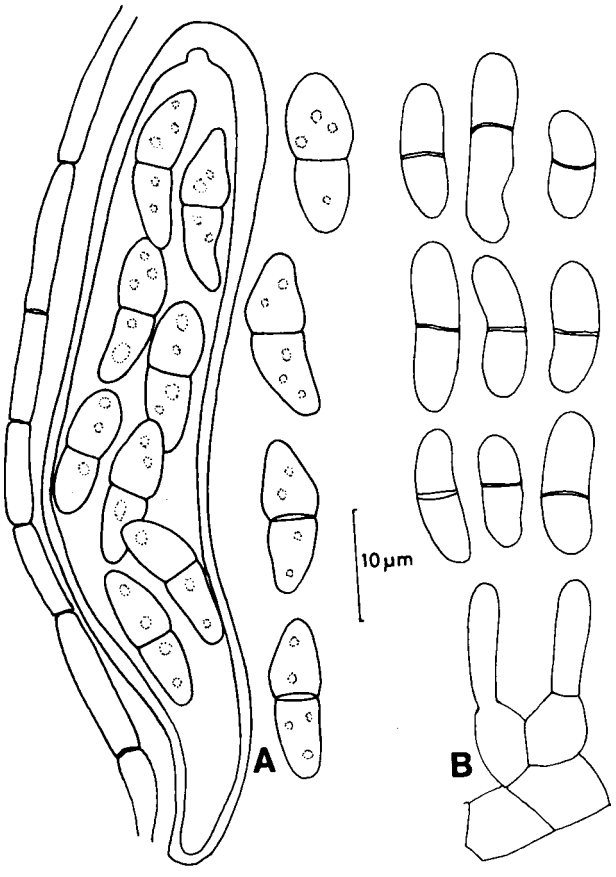


Fig. 243. *Didymella lethalis.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Pseudothecia up to 160 µm broad. Asci 65-80 × 14-16 µm. Ascospores elliptical, slightly constricted, guttulate, 13-19 × 7-9 µm.

Pycnidia erumpent, up to 120 µm broad. Conidia oblong cylindrical, 1 or rarely 2 septate, not or slightly constricted at the septum, 10-17 × 3-5 µm.

On stems of *Melilotus albus & M. officinalis,* U.S.A.

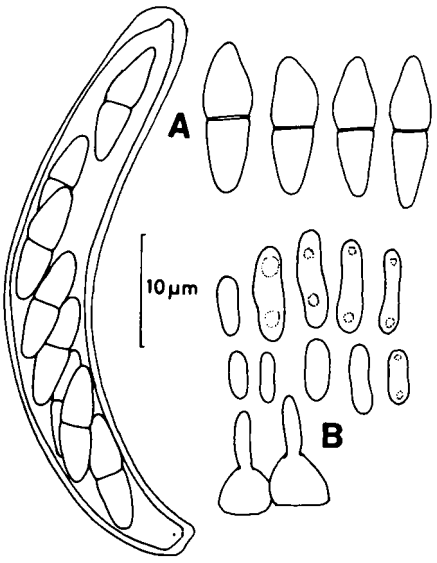


Fig. 244. *Didymella nigra* (type). A, ascus and ascospores; B, conidiogenous cells and conidia.

D. lycopersici Klebahn, *Z. Pflkrankh. PflPath. PflSchutz* **31:** 12, 1921 (Fig. 242A,B).

Anamorph: *Ascochyta lycopersici* (Plowright) Brunaud, *Bull. Soc. Bot. Fr.* **34:** 430, 1887.

Sphaeronaema lycopersici Plowright, *Gard. Chron.* **16:** 260, 1881.
Phoma lycopersici (Plowright) Jaczewski, *N. Mem. Soc. Imp. Natur. Moscow* **15:** 350, 1898.
Diplodina lycopersici Hollós, *Ann. Mus. Natur. Hung.* **5:** 461, 1907.
Diplodina lycopersici (Cooke) Holl. emend Brooks & Searle, *Trans. Br. mycol. Soc.* **7:** 192, 1921.

Pseudothecia up to 300 µm broad. Asci cylindrical to subclavate, 50-95 × 6-10 µm. Ascospores ellipsoidal, ends obtuse, slightly constricted at the septum, guttulate, 12-18 × 5-6 µm.

Pycnidia solitary to aggregated, immersed, becoming erumpent, up to 250 µm broad. Conidia hyaline, ellipsoid to ovoid, guttulate, 0-1 septate, 5-10 × 2-3 µm.

On stems, leaves and fruits of *Lycopersicon esculentum* causing stem and fruit rot. Also on *Solanum melongena*. Cosmopolitan.

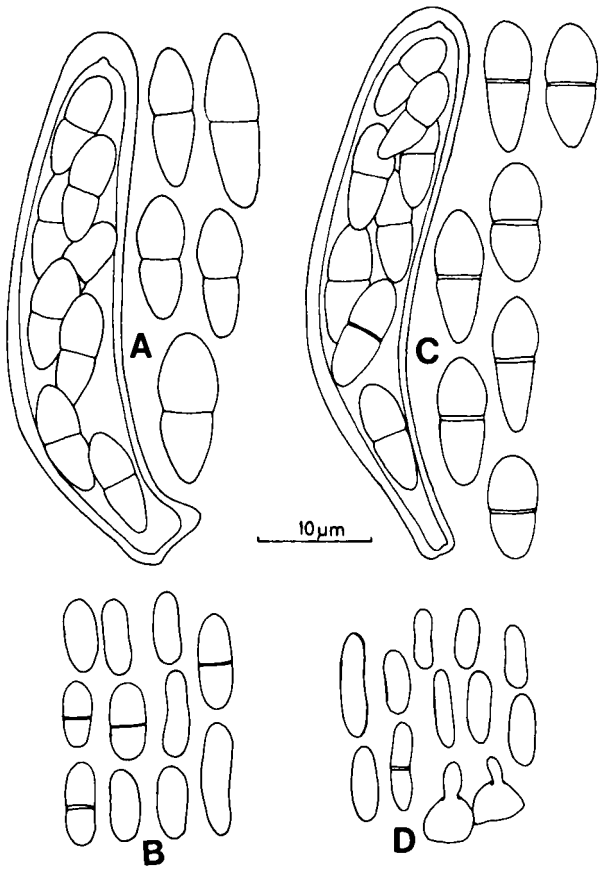


Fig. 245. *Didymella vitalbina*. A, ascus and ascospores; B, conidia. *D. phacae* (type). C, ascus and ascospores; D, conidogenous cells and conidia.

Holliday & Punithalingam (1970) has given account of the morphology, disease, symptoms and control of this species.

D. nigra Corbaz, *Phytopath. Z.* **28:** 408, 1957 (Fig. 244).

Pseudothecia blackening the substrate, up to 210 µm broad. Asci 45-60 × 7-8 µm. Ascospores fusoid, 10-12 × 4-5 µm.

Pycnidia mixed with pseudothecia on host as well as obtained in culture from ascospore isolates (Corbaz, 1957), similar to pseudothecia. Conidia hyaline, one celled, ovoid, elliptical or rod shaped, 4-11.5 × 2-4 µm.

On dead stems of *Astragalus pentaglotis, A. glycyphyllus, A. cicer, Galega officinalis, Melilctus albus, Ononis natrix, O. repens.* Europe.

D. phacae Corbaz, *Sydowia* **9:** 229, 1955 (Fig. 245C.D).

Anamorph: *Ascochyta* sp. (Corbaz, 1957).

Pseudothecia up to 300 μm broad. Asci 48-55 × 9-12 μm. Ascospores 11-12 × 4-5 μm.

Pycnidia formed in culture from ascospore isolates, up to 300 μm broad. Conidia hyaline, rod shaped, 0-1 septate, 7-10 × 2-4 μm.

On dead stems of *Phaca alpina.* Switzerland.

D. phleina Punith. & Kåre Årsvoll in Punith., *Mycol. Pap.* **142:** 171, 1979 (Fig. 246).

Anamorph: *Ascochyta* sp.

Pseudothecia up to 140 μm broad. Asci 50-70 × 10-12 μm. Ascospores fusiform to ellipsoidal, septate in the middle, 16-18 × 4-5 μm, guttulate.

Pycnidia up to 250 μm broad. Conidia very pale straw yellow, guttulate, oblong to broadly ellipsoidal, 1 septate, smooth or finely roughened, 18-24 × 5.5-8 μm, borne on hyaline, doliiform, phialidic conidiogenous cells.

Isolated from *Phleum pratense,* Norway. Also on *Bromus carinatus, Hordeum vulgare, Lolium* spp., *Melica altissima* and *Phleum phleoides.*

D. pinodes (Berk. & Blox.) Petrak, *Annls mycol.* **22:** 16, 1924 (Fig. 247).

(For synonyms refer to Punith. & Holliday, 1972).

Anamorph: *Ascochyta pinodes* L.K. Jones, *Bull. N.Y. St. agric. Exp. Stn.* **547:** 4, 1927; (as *A. pinodes* (Berk. & Blox.) Jones).

Pseudothecia up to 180 μm broad. Asci 50-80 × 10-15 μm. Ascospores ellipsoid, constricted at the septum, 8-18 × 4-8 μm with rounded ends. Pycnidia immersed then erumpent, single or gregarious, globose, with papillate ostioles. Conidia hyaline, 1 septate, ellipsoid, not or slightly constricted at the septa, guttulate, 8-19 × 3-5 μm, sometimes 2-3 septate.

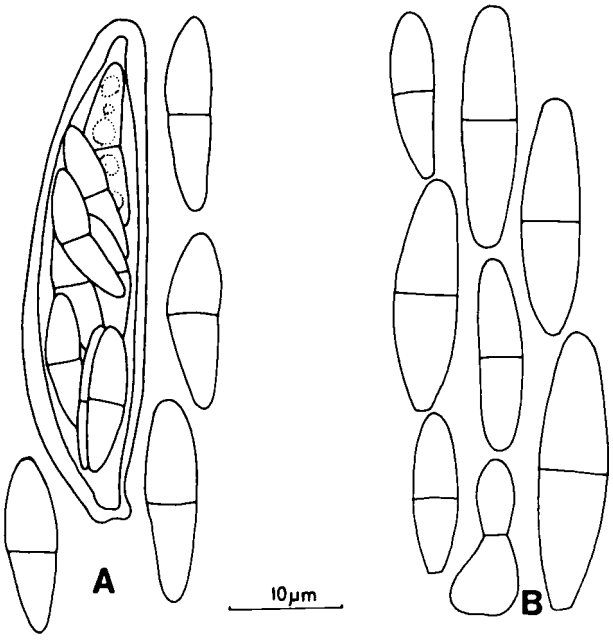


Fig. 246. *Didymella phleina* (type). A, ascus and ascospores; B, conidiogenous cell and conidia.

On stems, leaves, pods and seeds of *Lathyrus, Pisum sativum, Phaseolus* and *Vicia,* causing leaf, stem and pod spot and foot rot of pea. Widespread, C.M.I. Description Map 316, 1967. Punithalingam & Holliday (1972) have briefly described the morphology, disease and control of this species.

D. proximella (P. Karsten) Sacc., *Syll. Fung.* **1:** 558, 1882 (Fig. 248).

Sphaerella proximella P. Karsten, *Mycol Fenn.* **2:** 177, 1873.
Didymosphaeria kunzei Niessl, *Hedwigia* **15:** 106, 1876.
Sphaerella hyperopta Rehm, *Ascomyceten Exsicc.* 348, 1876?
Sphaeria refracta Cooke, *Grevillea,* **5:** 119, 1877.
Didymella refracta (Cooke) Sacc., *Syll. Fung.* **1:** 560, 1882.

Anamorph: *Stagonospora* sp.

Pseudothecia subepidermal, up to 200 µm broad. Asci clavate to broadly clavate, 67-95 × 19-23 µm. Ascospores septate slightly below the middle, occasionally in the middle, inequilateral to slightly curved, constricted at the septum, 20-26 × 7.5-9 µm, bi-guttulate.

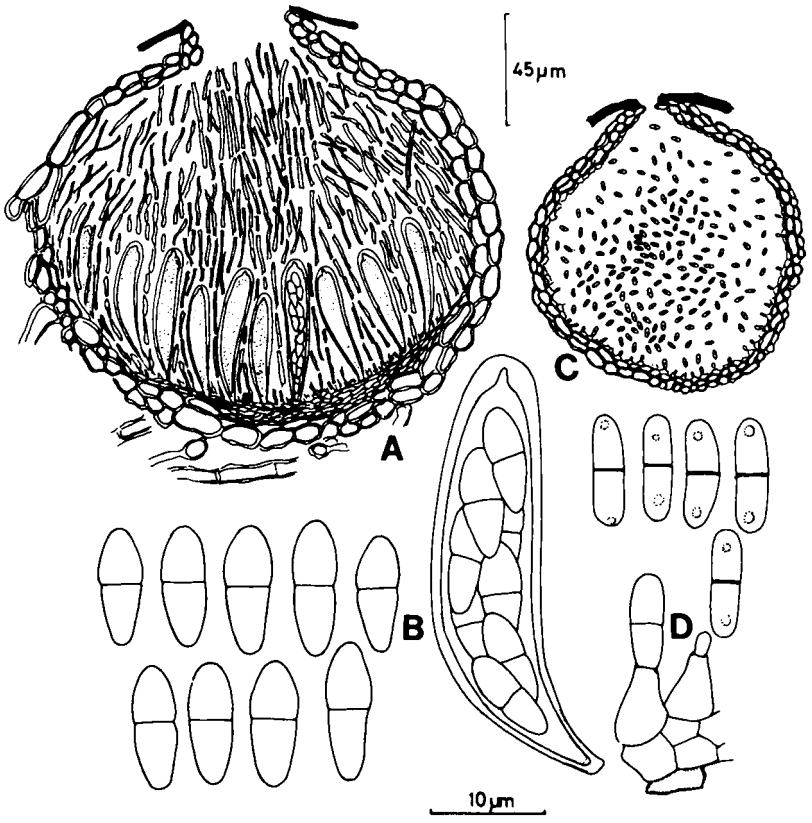


Fig. 247. *Didymella pinodes.* A, v.s. pseudothecium; B, v.s. pycnidium; C, ascospores; D, conidiogenous cells and conidia.

Pycnidia immersed, up to 230 µm broad. Conidiogenous cells annellidic, hyaline, ampulliform to doliiform. Conidia hyaline fusoid, 20-34 × 6.5-9.5 µm, 2-3 septate, wider in the middle, slightly constricted at the septa, guttulate, with a rounded apex and truncate base. Ascospore isolates produced pycnidia in culture.

On overwintered stalks of *Carex californica,* U.S.A., leaves of *Carex acuta,* Europe. Corlett & Smith (1978) have given a good description of both the perfect and imperfect state of this fungus.

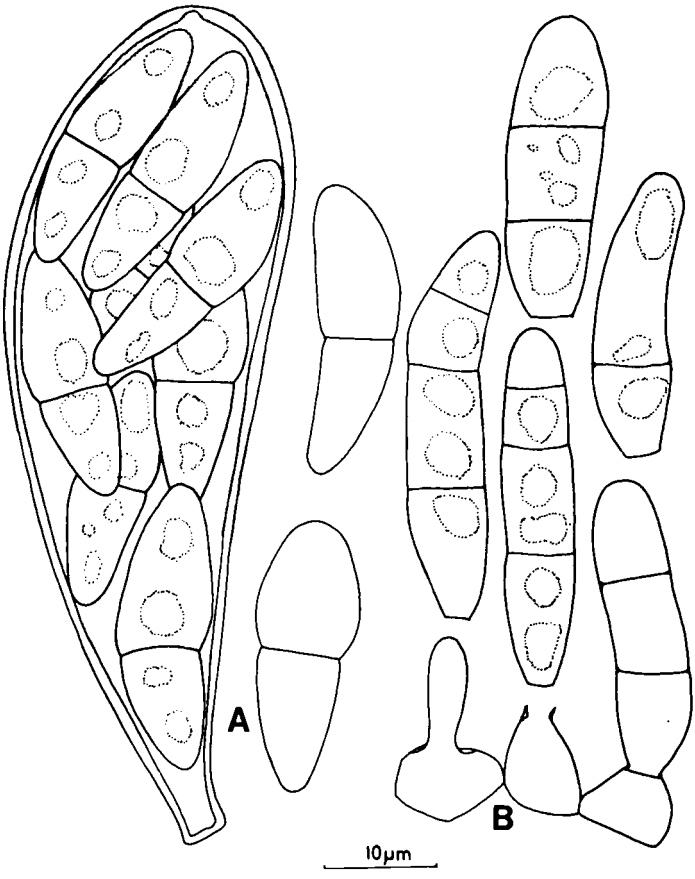


Fig. 248. *Didymella proximella.* A, ascus and ascospores; B, conidiogenous cells and conidia.

D. urticicola van der Aa & Boerema, *Trans. Br. mycol. Soc.* **67:** 303, 1976 (Fig. 249).

Anamorph: *Phoma urticicola* van der Aa & Boerema, *ibid.* 1976.

Pseudothecia intermixed with pycnidia up to 440 µm broad. Asci 40-65 × 8-12 µm. Ascospores ellipsoidal to ovoid, mostly with the base somewhat attenuated, constricted at the septum 12-18 × 5.5-7.5 µm, rarely becoming 3-4 septate at maturity.

Pycnidia up to 500 µm broad. Conidia hyaline, irregularly cylindrical, mostly biguttulate, one celled, 3.4-8.5 × 2-3.5 µm.

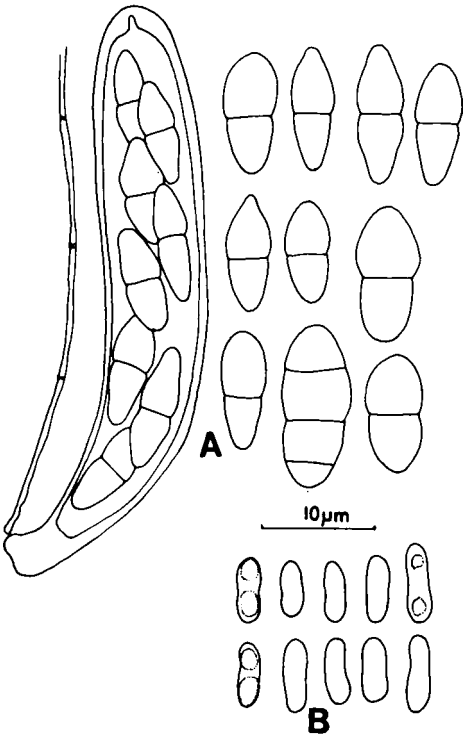


Fig. 249. *Didymella urticicola* (type). A, ascus and ascospores; B, conidia.

On dead leaves of *Urtica dioica*. Europe. Other species described on *Urtica dioica* are *Didymella eupyrena* Sacc. and *Mycosphaerella superflua* (Auersw.) Petrak. This species differs from *D. eupyrena* which also produces a *Phoma* anamorph by smaller and unequally septate ascospores and smaller conidia, from *M. superflua* in the pseudothecial character and in the different anamorph which is a *Ramularia* in *M. superflua*.

D. valeriana Corbaz, *Phytopath. Z.* **28**: 396, 1957 (Fig. 250).

Anamorph: *Phoma* sp.

Pseudothecia up to 230 µm broad. Asci 75-90 × 10-12 µm. Ascospores septate in the middle, sometimes just below the middle, constricted at the septum, 16-18 × 5-7 µm.

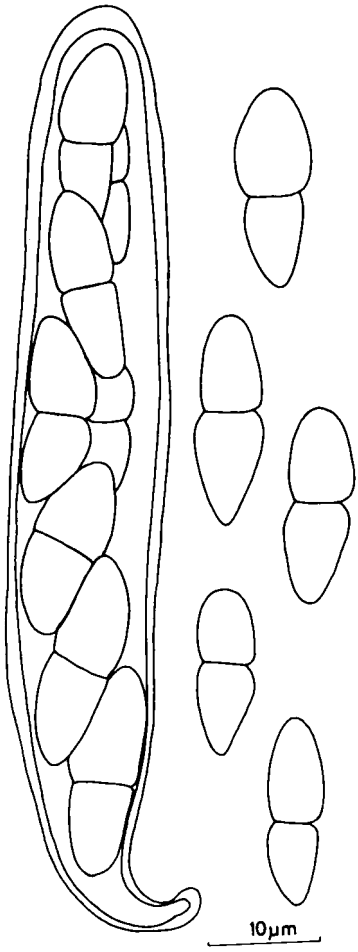


Fig. 250. *Didymella valeriana* (type). Ascus and ascospores.

Pycnidia formed in culture from ascospore isolates (Corbaz, 1957), up to 200 µm broad. Conidia hyaline, one celled, rod shaped, 4-11 × 2-3.5 µm.

On branches of *Valeriana montana*. Switzerland.

D. vincetoxici (de Not.) Sacc., *Syll. Fung.* **1:** 552, 1882. (Fig. 251).

Amphisphaeria vincetoxici de Not., *Sf. Ital.:* 72, 1863.
Didymella mutisiana Unam., *Bol. Soc. Espan. Hist. Nat.* **32:** 443, 1932.

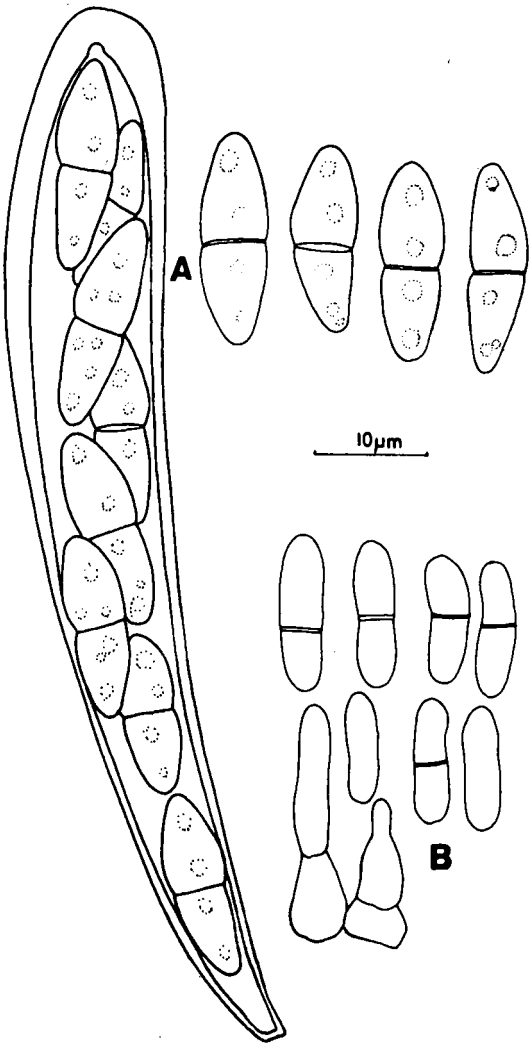


Fig. 251. *Didymella vincetoxici.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Didymella cretica Petrak, *Denkschr. Akad. Wiss. Wien* **105:** 9, 1943.

Anamorph: *Ascochyta* sp. (Corbaz, 1957).

Pseudothecia subcuticular, up to 450 µm broad. Asci 90-105 × 11-12 µm. Ascospores septate in the middle, somewhat constricted at the septum, 16-19 × 5.5-8 µm.

Pycnidia formed from ascospore cultures (Corbaz, 1957). Conidia hyaline, cylindrical, 1 septate, 10-19 × 3-6 μm. According to Corbaz, the anamorph resembles *Ascochyta asclepiodearum* Trav. var. *macrospora* Massal.

On *Vincetoxicum officinale*. Europe.

D. vitalbina Petrak, *Annls mycol.* **38:** 348, 1940 (Fig. 245 A,B).

Anamorph: *Phoma* sp.

Pseudothecia up to 200 μm broad. Asci 45-56 × 10-12 μm. Ascospores oblong ovoid to somewhat clavate, septate in the middle, distinctly attenuate, somewhat constricted at the septum, 12-18 × 5.5-7.8 μm.

Pycnidia associated with pseudothecia on host. Conidia hyaline, ovoid to ellipsoidal, 5-7 × 3-3.5 μm.

On dead stems of *Clematis vitalba*. Austria.

D. vodakii E. Müller, *Sydowia* **7:** 332, 1953 (Fig. 252).

Anamorph: *Ascochyta vodakii* Bubak, *Nov. Kozlem.* **4:** 52, 1907.

Ascochyta hepaticae Died., *Krypt.-Fl. M. Brandenb.* **9:** 385, 1915.

Pseudothecia up to 200 μm broad. Asci 60-70 × 10-12 μm. Ascospores clavate, 15-22 × 5.5-7 μm, septate in the middle or septate just above the middle with a short but wider upper cell.

Pycnidia on leaves up to 180 μm broad. Conidia hyaline, cylindrical, septate in the middle, 13-22 × 4-5.5 μm, not or slightly constricted at the septum.

On *Hepatica triloba*. Europe.

EUDARLUCA Speg., *Revta Mus. La Plata* **15:** 22, 1908.

Parabotryon H. Sydow, *Annls mycol.* **24:** 374, 1926.
Cryptocrea Petrak, *Annls mycol.* **35:** 82, 1937.
Xenodimerium Petrak, *Sydowia* **1:** 190, 1947.

Type sp.: *E. caricis* (Fr.) O. Erikss., *Bot. Not.* **119:** 35, 1966 (= *E. australis* Speg.).

Anamorph: *Sphaerellopsis* Cooke

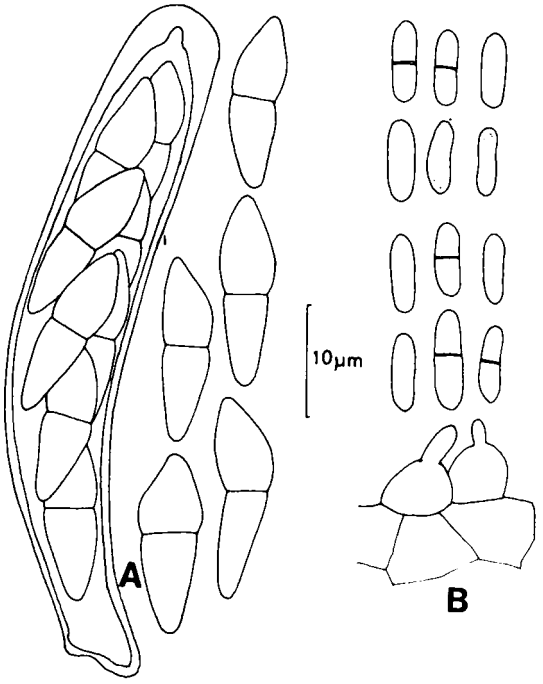


Fig. 252. *Didymella vodakii.* A, ascus and ascospores; B, conidiogenous cells and conidia.

E. caricis (Fr.) O. Eriks., *Bot. Not.* **119:** 35, 1966 (Fig. 253).

Sphaeria caricis Fr., *Syst. Mycol.* 2: 435, 1923.
Eudarluca australis Speg., *Revta Mus. La Plata* 15: 22, 1908.

For additional synonyms refer to Eriksson (1966).

Anamorph: *Sphaerellopsis filum* (Biv.-Bern.: Fr.) B. Sutton, *Mycol. Pap.* **141:** 1977.

Phoma filum Biv.-Bern.: Fr., *Syst. Mycol.* **2:** 547, 1823.
Sphaeria filum Biv.-Bern., *Stirp. Sicilia, Man.* **3:** 12 (1813-1816).
Darluca filum (Biv.-Bern.: Fr.) Berk., *Outline of British Fungology:*318, 1860.

For additional synonyms refer to Sutton (1980).

Stromata developing in rust sori, variable in shape, unilocular to multilocular. Loculi immersed, subglobose to ampulliform, often with protruding conical neck, up to 250 µm broad with a wall of 1-2 layers of

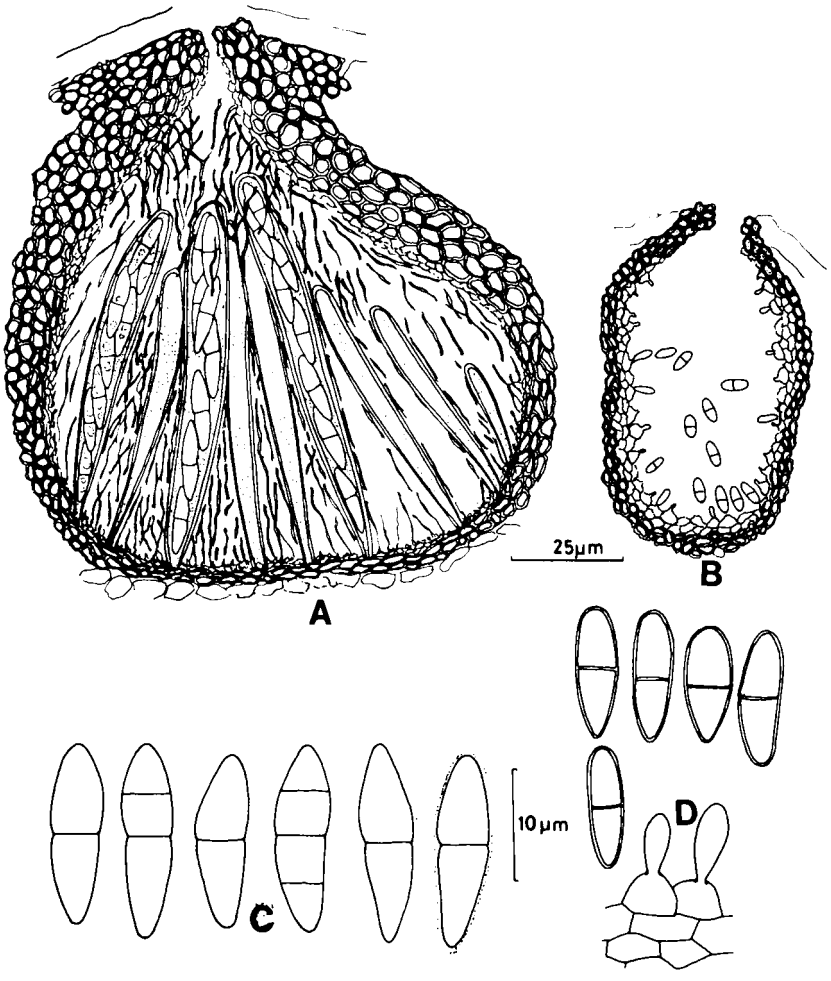


Fig. 253. *Eudarluca caricis.* A, v.s. pseudothecium; B, v.s. pycnidium; C, ascospores; D, conidiogenous cells and conidia.

pseudoparenchymatous, dark brown cells. Asci numerous, 8-spored, 55-90 × 8-11 µm. Ascospores irregularly biseriate in the ascus, fusoid, hyaline to very pale yellow 1(-2-3) septate, 13-22 × 3-4.5 µm, smooth with gelatinous cupola at each end or the cupolas dissolving and the remainder of the wall enclosed in a rather thin 'decapitated' gelatinous sheath. Pseudoparaphyses filmentous, branched.

Pycnidia dark brown, globose, ostiolate up to 100 µm broad, with a wall of thick walled, dark brown cells near the ostiole and less pigmented,

thin-walled cells below. Conidia hyaline to pale brown, smooth, septate, 0-1, not or slightly constricted at the septum, 13-19.5 × 2.2-6.5 μm, formed on hyaline, short, obpyriform to doliiform, enteroblastic, phialidic conidiogenous cells lining the cavity of the pycnidium. In addition spermatia which are hyaline, one celled, 2-3 × 1 μm are formed in small spermogonia.

This is a cosmopolitan Uredinicolous pyrenomycete (Eriksson, 1966); Kranz (1973) has compiled a host list of this rust parasite.

GEMMAMYCES Casagrande, *Phytopath. Z.* **66:** 119, 1966.

The genus is monotypic.

G. piceae (Borthw.) Casagrande, *Phytopath. Z.* **66:** 119, 1969 (Fig. 254).

Cucurbitaria piceae Borthwick, *Notes on Roy, Bot. Gdns* **4:** 259, 1901.
Megalospora gemmicida Naumov, *Mat. Mycol. Phytopath. Jacz.* **6:** 9, 1927
Cucurbitariopsis gemmicida (Naum.) Vassilkov, *J. Bot. USSR* **45:** 1369, 1960.

Anamorph: *Megaloseptoria mirabilis* Naumov, *Bolezni Rastenii* **14:** 144, 1925.

Ascostromata sessile or stalked, superficial, glabrous, gregarious, globose, dark brown, 300-600 μm in diam., with a rounded ostiole 30-50 μm in diam. on a basal prosenchymatous stroma. The wall 35-70 μm thick is composed of several layers of polygonal to angular cells which are dark brown and thick walled on the outer layers and more or less thin walled and hyaline towards the interior. Asci cylindrical, 8 spored, 18-25 × 25-30 μm. Ascospores fusiform, pale to mid brown, smooth, transversely 5-8 (mostly 7) septate, with usually one vertical septum in all but the end cells, sometimes with a Y shaped septum in one of the end cells, constricted at the middle septum, 35-50 × 13-15 μm. Pseudoparaphyses numerous, persistent, hyaline, filiform, branched, septate.

Pycnidia single, sessile, aggregated, glabrous, thick walled, dark brown, unilocular, globose, 400-600 μm in diam., with a rounded apical pore, 40-60 μm wide. The wall, 35-55 μm thick, is composed of thick walled angular cells on the outside and more or less thin walled hyaline cells towards the interior. Conidiophores hyaline, branched, smooth, septate at the base, thin walled, 8-15 μm thick formed on the inner wall of the pycnidium. Conidiogenous cells enteroblastic, determinate, discrete, integrated, doliiform, ampulliform or sometimes more or less cylindri-

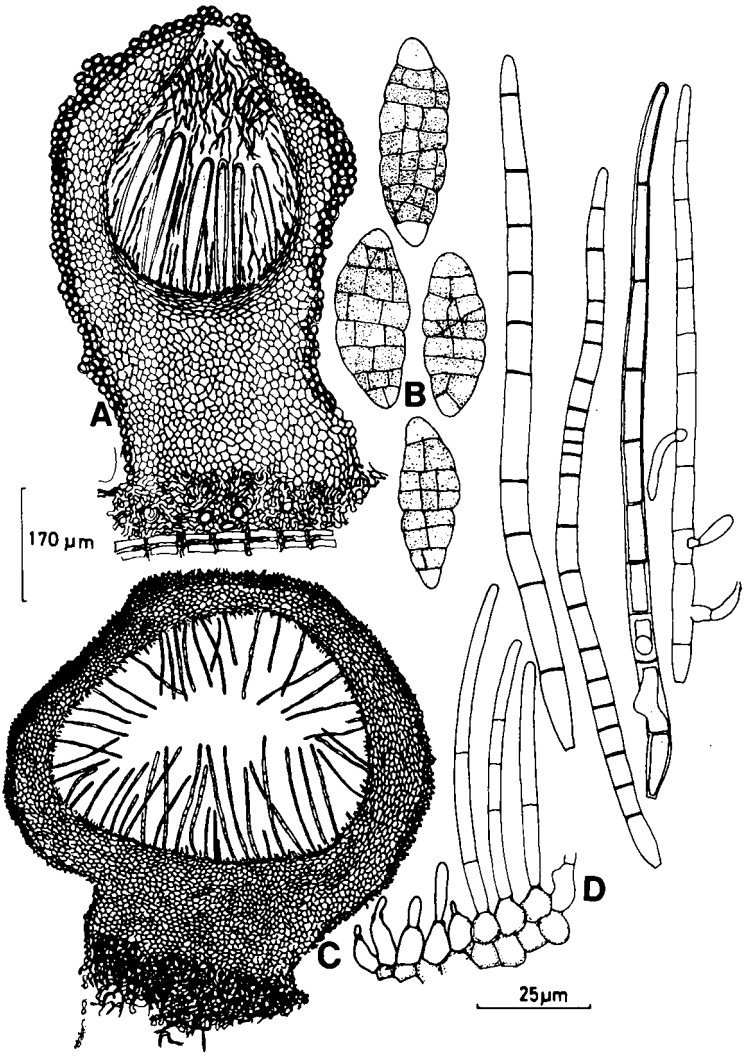


Fig. 254. *Gemmamyces piceae*. A, v.s. ascostroma; B, ascospores; C, v.s. pycnidium; D, conidiophores and conidia.

cal, smooth, hyaline with a collarette. Conidia scolecoid, hyaline to pale olivaceous, 7-21 (31-46), septate, transversely septate, 150-200 × 5-9 µm (according to Shoemaker(1967)220-315 µm long), with a truncate base and slightly narrowed but rounded apex, formed successively from a phialidic aperture.

Parasitic on buds of *Picea*. Austria, Denmark, Finland, Scotland(U.K.) Switzerland.

HERPOTRICHIA Fuckel, *Fungi Rhenani exs. no.* 2171, 1868, in sched...

Enchnosphaeria Fuckel, *Symb. mycol.* :146, 1870.
Neopeckia Sacc., *Bull. Torrey bot. Club* **10:** 127, 1883.
Didymotrichia Berl., *Atti Congr. Bot. Intern., Genova* **1892:** 572, 1893.
Lojkania Rehm, *Növényt. Kozlem.* **4:** 2, 1905.
Xenonectria Höhnel, *Sber. Akad. Wiss. Wien* **129:** 149, 1920.
Khekia Petrak, *Hedwigia* **62:** 284, 1921.
Sydowina Petrak, *Annls mycol.* **21:** 182, 1923.
Pseudotrichia Kirschst., *Annls mycol.* 37: 125, 1939.

Type sp.: *H. rubi* Fuckel, *Fungi Rhenani exs.* no. 2171, 1868.

Anamorphs: *Pyrenochaeta* or *Pyrenochaeta*-like (Schneider, 1979).

Now that the type species of *Herpotrichia* has been established (Cannon, 1982; C.L. Holm, 1979) it is evident that some genera like *Lojkania* and *Neopeckia* synonomized under *Herpotrichia* (Sivanesan, 1971a, Bose, 1961; Pirozynski, 1972; Samuels & Müller, 1978) should be separated as distinct taxa on the basis of the nature of their fruit body and peridium structure, ascus and ascospore characters.

Parasites, hyperparasites or saprophytes. Pseudothecia spherical, pyriform or obpyriform, subglobose, superficial, often with a flattened base, slightly embedded in the host substratum, non stromatic, crowded or widely scattered on a felt-like matted mycelial byssus of brown hyphae and beset with long or short hyphae or setae, ostiolate at maturity, apex non papillate, sometimes flattened, sometimes growing in empty stroma locules of other ascomycetes. The pseudothecial wall of textura angularis or polygonalis is composed of thick walled, dark brown cells in the outer layers and thin walled hyaline cells towards the inner layers. Asci clavate to cylindrical, 4-8 spored, stalked, with a distinct 'nasse apicale'. Ascospores hyaline at first, then pale to dark brown, one to many septate, often surrounded by a gelatinous sheath which may project as hyaline appendages at the ends, fusiform, elliptic, sometimes biconic, with or without longitudinal ridges, straight or curved, constricted or not constricted at the septa. Pseudoparaphyses hyaline, branching, anastomosing, usually gelatinous.

Pycnidia solitary or in a dense stromatic crust on the surface of the agar, with or without hairs, globose to subglobose or hemispherical, composed of a wall of textura angularis, ostiolate. Conidiogenous cells cylindrical or simple or branched or phialidic. Conidia globose elliptic to allantoid, hyaline, one celled.

Pyrenochaeta pycnidia with branched cylindrical conidiophores and

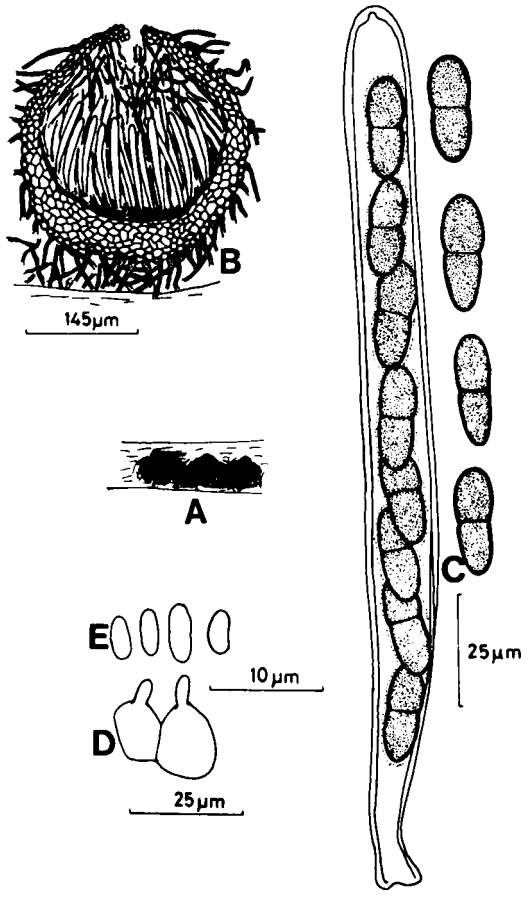


Fig. 255. *Herpotrichia coulteri* (type). A, pseudothecia; B, v.s. pseudothecium; C, ascus and ascospores; D, conidiogenous cells; E, conidia.

hairs or setae are found in *H. diffusa, H. parasitica, H. rubi* and *H. schiedermayeriana.* In the other four species, *H. coulteri, H. juniperi, H. rhodosticta* and *H. villosa* the pycnidia lack hairs and the phialides are simple (Samuels & Müller, 1978).

Key to Herpotrichia species with anamorphs

Ascospores remaining 1 septate..... 1

Ascospores 1-3(4) septate..... 2

1. Ascospores 16-18 × 4-5 μm..... *H. diffusa*
   Ascospores 17-23 × 5-7 μm..... *H. rhodosticta*
   Ascospores 20-28 × 7-10 μm..... *H. coulteri*
2. Ascospores 15-22 × 3.5-5 μm..... *H. parasitica*
   Ascospores 18-27 × 5-9.5 μm..... *H. rubi*
   Ascospores 23-34 × 8-12 μm..... *H. juniperi*
   Ascospores 23-43 × 7-13 μm..... *H. villosa*
   Ascospores 26-48 × 4-11 μm..... *H. schiedermayeriana*

H. coulteri (Peck) Bose, *Phytopath.Z.* **41:** 195, 1961 (Fig. 255).

Sphaeria coulteri Peck in Hayden, *U.S.Geol.Surv.:* 792, 1872.
Lasiosphaeria acicola Cooke, *Grevillea* **8:** 87, 1880.
Amphisphaeria acicola (Cooke) Sacc., *Syll.Fung.* **1:** 727, 1882.
Enchnosphaeria coulteri (Peck) Sacc., *Syll. Fung.* **2:** 207, 1883.
Neopeckia coulteri (Peck) Sacc. in Peck, *Bull. Torrey bot.Club* **10:** 127, 1883.
Lasiosphaeria coulteri (Peck) Ell. & Ev., *North Am. Pyren.:* 147, 1892.
Didymotrichia coulteri (Peck) Berl., *Atti Congr. Intern. Genova:* 573, 1892.

Anamorph: *Pyrenochaeta* sp. (Bose, 1961).

Pseudothecia superficial in a subiculum, up to 500 μm broad, solitary or in small groups. Asci 140-210 × 14-20 μm. Ascospores uniseriate in the ascus, dark brown, 1 septate, constricted at the septa, thick walled, 20-28 × 7-10 μm, with a mucilaginous sheath when young.

Pycnidial anamorph formed in culture from ascospore isolate (Bose, 1961). Pycnidia up to 200 μm broad. Conidiophores cylindrical, simple, 10-20 × 2 μm. Conidia hyaline, one celled, ovoid, 2.5-4 × 1.5-2 μm.

On leaves and stems of *Picea* and *Pinus*. Europe, U.S.A.

H. diffusa (Schwein.) Ell. & Ev., *North Am. Pyren.:* 158, 1892 (Fig. 256).

Sphaeria diffusa Schwein., *Trans.Am.Phil.Soc.* **4:** 210, 1834.
Sphaeria rhodomphala Berk., *J.Bot.Lond.* **4:** 313, 1845.
Sphaeria parietalis Berk. & M.A. Curtis, *Grevillea* **4:** 107, 1876.
Enchnosphaeria parietalis (Berk. & M.A. Curtis) Sacc., *Syll. Fung.* **2:** 207, 1883.
Herpotrichia rhodomphala (Berk.) Sacc., *Syll. Fung.* **2:** 212, 1883.

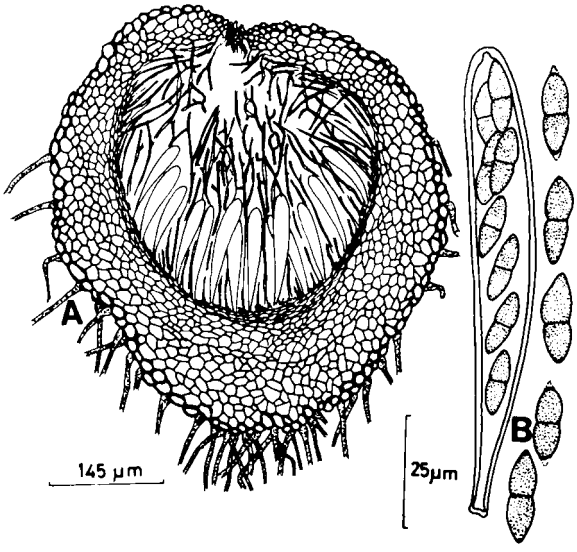


Fig. 256. *Herpotrichia diffusa*. A, v.s. pseudothecium; B, ascus and ascospores.

Byssosphaeria (Amphisphaeria) diffusa (Schwein.) Cooke, *Grevillea* **15:** 81, 1887.
Herpotrichia parietalis (Berk. & M.A. Curtis) Ell. & Ev., *North Am.Pyren.:* 157, 1892.
Didymotrichia diffusa (Schwein.) Berl., *Atti Congr.Intern.Genova:* 572, 1892.
Didymotrichia parietalis (Berk. & M.A. Curtis) Berl., *Atti Congr.Intern.Genova:* 573, 1892.
Neopeckia diffusa (Schwein.) Starb., *Bih. K. Svenska Vetensk. Akad.Handl.* **19:** 30, 1894.
Neopeckia parietalis (Berk. & M.A. Curtis) Sacc., *Syll. Fung.* **11:** 317, 1895.

Pseudothecia spherical to pyriform, scattered or crowded, superficial on a subiculum, up to 400 µm broad. Asci 70-100 × 10-20 µm. Ascospores one septate, brown, pointed and darker at the ends, constricted at the septum, 16-18 × 4-5 µm, with a gelatinous appendage projecting beyond the ends.

Pycnidial anamorph formed in culture from ascospore isolates (Bose, 1961). Pycnidia pyriform, papillate or with long necks, up to 400 µm broad. Conidiophores simple or branched, septate, 5-12 × 1.5-2.5 µm. Conidia hyaline, one celled, ovoid, 2-3 × 1-1.5 µm.

On wood and branches of various angiospermous dicotyledous. Cosmopolitan.

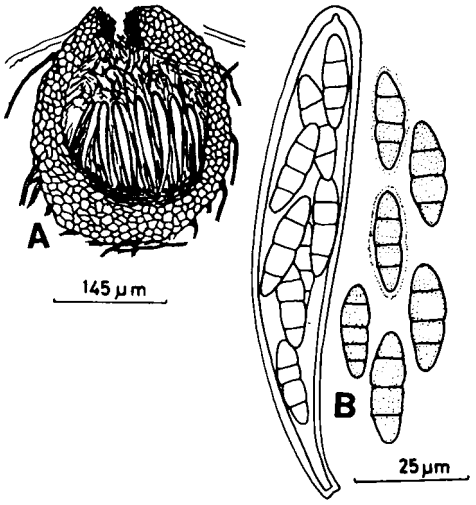


Fig. 257. *Herpotrichia juniperi* (type). A, v.s. pseudothecium; B, ascus and ascospores.

H. juniperi (Duby) Petrak, *Annls mycol.* **23:** 43, 1925 (Fig. 257).

Sphaeria juniperi Duby, Klotzsch Herb. Myc. no. 1833, 1854.
Ozonium plica Kalchbr., *Math. es Termesz. Kozlem.* **2:** 159, 1862.
Sphaeria pinetorum Fuckel, *Hedwigia* **7:** 14, 1868.
Enchnosphaeria pinetorum (Fuckel) Fuckel, *Symb. mycol.*: 147, 1870.
Enchnosphaeria santonensis Sacc., *Michelia* **2:** 66, 1880.
Bertia querceti Rehm, *Syll. Fung.* **1:** 583, 1882.
Lasiosphaeria scabra Auersw., *Syll. Fung.* **2:** 202, 1883.
Enchnosphaeria passicrinis Sacc., *Syll. Fung.* **2:** 206, 1883.
Herpotrichia pinetorum (Fuckel) Winter, *Die Pilze* **2:** 208, 1885.
Herpotrichia nigra Hartig, *Allg. Forst- u. Jagdztg.* **64:** 15, 1888.
Herpotrichia mucilaginosa Starb. & Grev., *Bih.K.svenska Vetens-Akad.Handl.* **16:** 8, 1890.
Laestadia? juniperi (Duby) Sacc., *Syll.Fung.* **9:** 585, 1891.
Enchnosphaeria nigra (Hartig) Berl., *Icon.Fung.* **1:** 105, 1892.

Mycelial subiculum felt-like. Pseudothecia globose to subglobose, superficial, up to 450 µm broad with a non papillate ostiole. Asci 115-190 × 12-18.5 µm. Ascospores overlapping uniseriate or obliquely biseriate in the ascus, 1 septate later becoming 3 septate, hyaline, pale brown to brown, 23-34 × 8-12 µm with a mucilaginous sheath which may not be present in mature spores.

Pycnidial anamorph formed in culture from ascospore isolates (Bose,

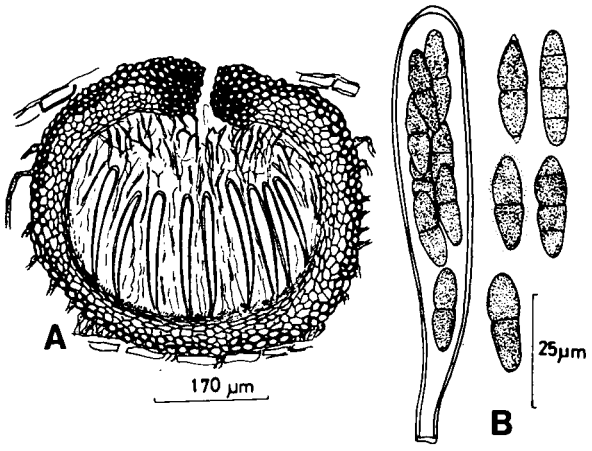


Fig. 258. *Herpotrichia rubi* (type). A, v.s. pseudothecium; B, ascus and ascospores.

1961). Pycnidia globose to pyriform, hairy, up to 200 µm broad, with a short ostiolar apex. Conidiophores short, simple, 6-10 × 1.5-2 µm. Conidia one celled, hyaline, 1.5-2.5 × 1-2 µm.

On needles and branches of *Abies, Juniperus, Picea, Pinus* and on branches of *Ulex europaeus*. Europe, U.S.A.

H. parasitica (Hartig) Rostrup, *Tid. Skovbrug* **12:** 222, 1890.

Trichosphaeria parasitica Hartig, *Allg.Forst.-u.Jagdztg.* **60:** 11-14, 1884.
Acanthostigma parasitica (Hartig) Sacc., *Syll. Fung.* **9:** 855, 1891.

Anamorph: *Pyrenochaeta parasitica* Freyer & van der Aa, *Europ.J.For. Path.* **5:** 179, 1975.

Mycelial subiculum composed of dark brown hyphae. Pseudothecia up to 220 µm broad, setose, superficial. Asci 60-80 × 7-9 µm. Ascospores fusoid, straight or curved, 1-4 mostly 3 septate, constricted at the septa, pale brown, 15-22 × 3.5-5 µm.

Pycnidia embedded in the subiculum, up to 350 µm broad, setose, globose, ostiolate. Conidiophores septate, branched, cylindrical, 25-70 × 1.8-3.5 µm. Conidia cylindrical, straight to curved, bi-guttulate, 3-6 × 1-2.5 µm.

On needles of *Abies, Picea* and *Tsuga*. Europe.

H. rubi Fuckel, *Fungi Rhenani exs. no.* 2171, 1868, in sched... (Fig. 258).

Sphaeria herpotrichoides Fuckel, *Fungi Rhenani exs. no.* 952, 1864.
Herpotrichia rhenana Fuckel, *Symb. mycol.:* 146, 1870.

Anamorph: *Pyrenochaeta rhenana* Sacc., *Syll. Fung.* **3:** 220, 1884.

Herpotrichopsis rhenana (Sacc.) Höhnel, *Sber.Akad.Wiss.Wien* **123:** 67, 1914.
Pyrenochaetella rhenana (Sacc.) Höhnel, *Hedwigia* **59:** 256, 1918.
Pyrenochaeta chaetomioides Sacc., *Malpighia* **11:** 309, 1897.

Mycelial subiculum of dark brown, superficial hyphae. Pseudothecia solitary or aggregated to form compound stroma, non papillate, up to 650 μm broad. Asci 100-160 × 11-15 μm. Ascospores uniseriate or biseriate in the ascus, fusoid, 1-3 septate, hyaline to pale brown, ends acute to subacute, 18-27 × 5-9.5 μm, constricted at the median septum, with gelatinous sheath projecting as hyaline appendages at the ends, more frequent on young than in mature spores.

Pycnidia subepidermal, becoming superficial, up to 600 μm broad, ostiolate. Conidiophores septate, simple, seldom branched, variable in length not more than 100 μm long. Conidia cylindrical, straight or slightly curved, hyaline, 4-6.5 × 0.8-1.2 μm.

On dead leaves of *Urtica dioica,* and stems of *Acer pseudoplatanus, Rubus idaeus* and *Rubus* spp. Germany, Great Britain.

H. rhodosticta (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 213, 1883 (Fig. 259).

Sphaeria rhodosticta Berk. & Br., *J. Linn.Soc.Lond.* **14:** 126, 1873.
Sphaeria lanuginosa Berk. & M.A. Curtis, *Grevillea* **4:** 108, 1876.
Melanopsamma lanuginosa (Berk. & M.A. Curtis) Sacc., *Syll. Fung.* **1:** 577, 1882.
Amphisphaeria subiculosa Ell. & Ev., *J. Mycol.* **2:** 103, 1886.
Byssosphaeria (Enchnosphaeria) lanuginosa (Berk. & M.A. Curtis) Cooke, *Grevillea* **15:** 123, 1887.
Herpotrichia lanuginosa (Berk. & M.A. Curtis) Ell. & Ev., *North Am.Pyren.:* 159, 1892.
Didymotrichia rhodosticta (Berk. & Br.) Berl., *Atti Congr. Intern. Genova:* 572, 1892.
Neopeckia rhodosticta (Berk. & Br.) Sacc., *Syll.Fung.* **11:** 317, 1895.
Nectria chaetostroma Ell. & Macbride, *Bull.Lab.Nat.Hist.Iowa State Univ.* **4:** 70, 1896.
Macbridella chaetostroma (Ell. & Macbride) Seaver, *Mycologia* **1:** 195, 1909.
Herpotrichia rhodospiloides Peck, *Bull. Torrey bot. Club* **36:** 154, 1909.

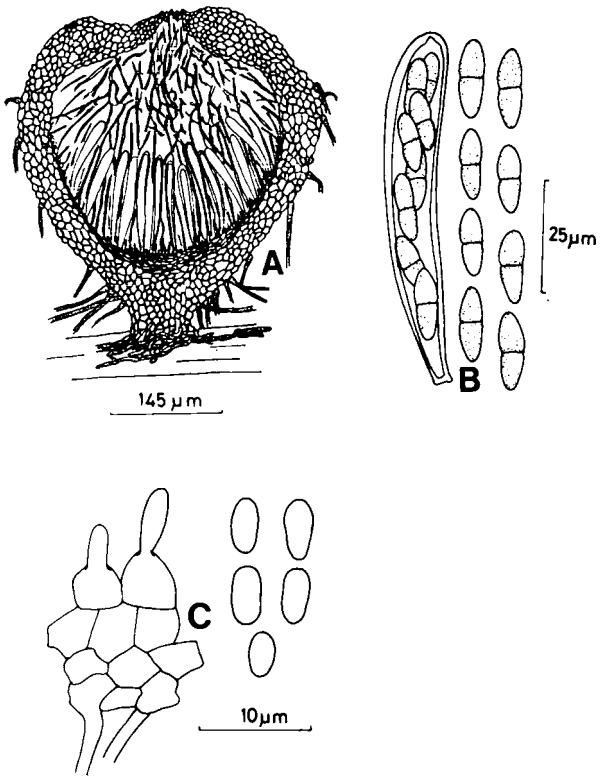


Fig. 259. *Herpotrichia rhodosticta* (type). A, v.s. pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

Letendraea chaetostroma (Ell. & Macbride) Weese, *Akad. Wiss. Wien.* 125: 512, 1916.

Anamorph: *Pyrenochaeta*-like (Samuels & Müller, 1978).

Pseudothecia superficial with or without basal stromata, up to 625 µm broad. Mycelium effused, subiculate. Asci 80-130 × 11-16 µm. Ascospores elliptic to subfusoid, straight or slightly curved, 1 septate with the upper cell shorter and broader than the lower cell, smooth, slightly constricted at the septum, pale brown, 17-23 × 5-7 µm.

Pycnidia formed in culture from ascospores (Samuels & Müller, 1978). Pycnidia up to 170 µm broad, hairy, 1-2 loculate. Phialides 5-10 × 4-6 µm with broad, unflared collarettes, arising singly from the cells lining the cavity. Conidia elliptic, one celled, hyaline, 6.5-10 × 3-4 µm. On decorticated angiospermous wood. Brazil, Philippines, Sri Lanka, U.S.A.

H. schiedermayeriana Fuckel, *Symb. mycol.* **2:** 27, 1873 (Fig. 260).

Sphaeria cirrhostoma Berk. & Br., *J. Linn. Soc. Lond.* **14:** 126, 1873.
Sphaeria (Byssisedae) keitii Berk. & Br. *Ann.Mag.nat.Hist.* **17:** 144, 1876.
Sphaeria (Byssisedae) albidostoma Peck, *A. Rep.N.Y.St.Mus.* **32:** 51, 1879.
Byssosphaeria keitii (Berk. & Br.) Cooke, *Grevillea* **7:** 84, 1879.
Lasiosphaeria cirrhostoma (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 201, 1883.
Herpotrichia keitii (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 212, 1883.
Lasiosphaeria (Leptospora) cirrhostoma (Berk. & Br.) Cooke, *Grevillea* **15:** 125, 1887.
Psilosphaeria (Zignoella) keitii (Berk. & Br.) Cooke, *Grevillea* **16:** 51, 1887.
Herpotrichia albidostoma (Peck) Sacc., *Syll. Fung.* **9:** 857, 1891.
Lasiosphaeria keitii (Berk. & Br.) Berl., *Icon.Fung.* **1:** 114, 1892.
Herpotrichia tonkiniana Pat., *Bull. Soc. mycol. Fr.* **8:** 51, 1892.
Herpotrichia incisa Ell. & Ev., *Proc. Acad.nat.Sci. Philad.* **45:** 130, 1893.
Herpotrichia schiedermayeriana Fuckel var. *caldariorum* Henn., *Hedwigia* **34:** 102, 1895.
Herpotrichia diffusa (Schwein.) Ell. & Ev. var. *rhodomphala* (Berk.) Ell. & Ev., *Proc. Acad.nat.Sci.Philad.* **47:** 21, 1895.
Herpotrichia sabalicola Henn., *Verh.bot.Ver.Prov.Brandenb.* **40:** 154, 1898.
Neopeckia robertii Starb., *Ark. Bot.* **5:** 16, 1905.
Neopeckia nobilis Rick, *Broteria* **5:** 44, 1906.
Herpotrichia cirrhostoma (Berk. & Br.) Petch, *Ann.R.bot.Gds.Peradeniya* **5:** 291, 1912.
Herpotrichia philippinensis Rehm, *Leafl. Philipp.Bot.* **6:** 2203, 1914.
Neopeckia rhodosticta (Berk. & Br.) Sacc. var. *magnifica* Rehm, *Leafl.Philipp. Bot. 8:* 2947, 1914.
Herpotrichia bakeri H. & P. Sydow, *Annls mycol.* **15:** 203, 1917.
Neopeckia rhodostoma H. & P. Sydow, *Annls mycol.* **15:** 204, 1917.
Xenonectria caldariorum (Henn.) Höhnel, *Sber.Akad.Wiss.Wien* **129:** 150, 1920.
Neopeckia brasiliana Viégas, *Bolm Soc.bras.Agron.* **9:** 2, 1946.

Mycelial subiculum composed of dark brown hyphae.

Pseudothecia superficial, densely aggregated in small groups, globose to doliiform, non papillate with cineraceous ostioler region, up to 700 μm broad. Asci 90-160 × 10-16 μm, pedicellate, clavate. Ascospores biseriate above and uniseriate below, fusiform, mostly straight 26-48 × 4-11 μm, 1 septate later becoming 3 septate after discharge, with hyaline appendages at each acute to subacute end; in some mature spores the appendage may not be present.

Pycnidial anamorph formed in culture from ascospore isolates (Samuels & Müller, 1978). Pycnidia globose, in concentric rings, up to 500 μm broad, with stiff hairs. Phialides almost globose or elongated, 5-10 × 3-6 μm with unflared collarettes. Conidia globose, elliptic to allantoid, hyaline, 2.5-4 × 1.5-3 μm.

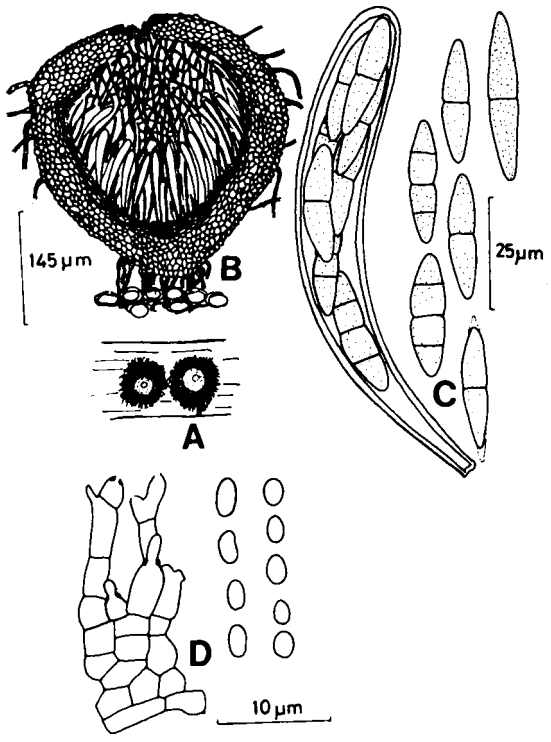


Fig. 260. *Herpotrichia schiedermayeriana* (type). A, pseudothecia; B, v.s. pseudothecium; C, ascus and ascospores; D, conidiophores and conidia.

On bark and decorticated angiospermous wood, on a piece of cord, orchid basket, dead roots, pine wood baskets, leaf sheaths and husks of palms, or fallen seeds. Argentina, Bermuda, Brazil, Indonesia, Italy, Philippines, Puerto Rico, Sierra Leone, Sri Lanka, U.S.A., Venezuela, Zaire.

H. villosa Samuels & E. Müller, *Sydowia* **31:** 158 (1978) 1979 (Fig. 261).

Mycelial subiculum thin to thick, woolly or sparse. Pseudothecia solitary to aggregate, superficial, globose to subglobose, non papillate, up to 500 µm broad. Asci 115-235 × 17-30 µm, 4-8 spored. Ascospores fusoid, 1 septate with 1 or 2 additional septa forming later, slightly constricted at the median septum, 23-43 × 7-13 µm, with a gelatinous sheath.

Pycnidial anamorph (*Pyrenochaeta*-like) formed in culture (Samuels &

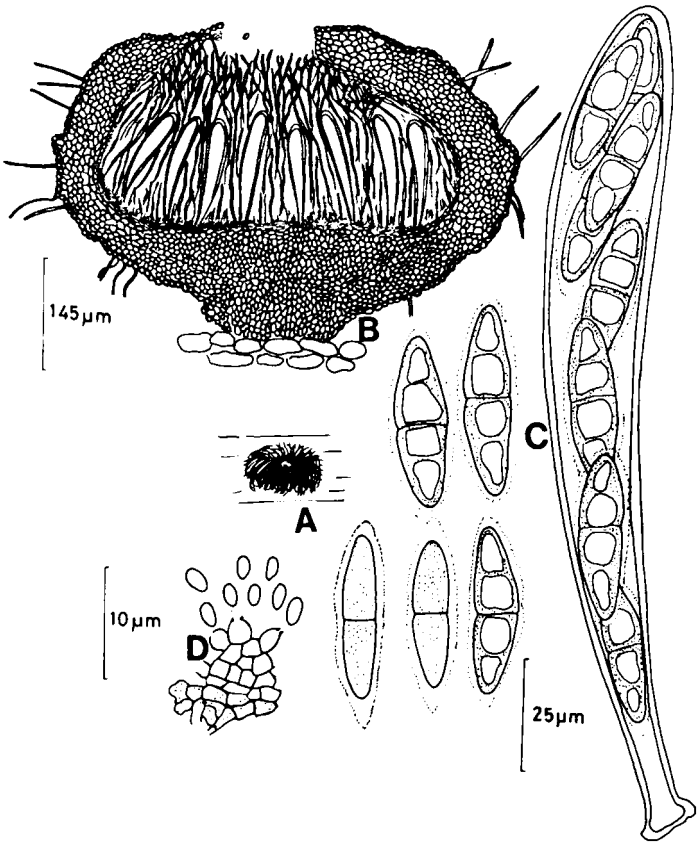


Fig. 261. *Herpotrichia villosa* (type). A, pseudothecium; B, v.s. of pseudothecium; C, ascus and ascospores; D, conidiophores and conidia.

Müller, 1978). Pycnidia in dense stromatic crust, hairy or glabrous, globose to hemispherical, up to 300 µm broad, ostiolate. Phialides globose 3-13 × 1.5-2 µm, with unflared collarettes. Conidia elliptic to allantoid, one celled, hyaline to yellow, 2.5-3.5 × 1.5-2 µm.

On bark and decorticated wood of angiospermous trees. Brazil.

LEPTOSPHAERIA Ces. & de Not., *Comm. Soc. Critt. Ital.* **1:** 234, 1863.

Bilimbiospora Auersw. in Rabenh., *Fungi europaei* No. 261, 1861?
Ampullina Quélet, *Mém. Soc. Émul. Montbéliard* ser. 2, **5:** 523, 1875.

Pocosphaeria (Sacc.) Berl., *Icon. Fung.* **1:** 89, 1892.
Macrobasis Starb., *Bot. Not.* **1893:** 31, 1893.
Baumiella Henn. in Warburg, *Kunene-Sambesi Exped.* **1903:** 165, 1903.
Phaeoderris (Sacc.) Höhnel, *Oesterr. bot. Zeit.* **57:** 322, 1907.
Phaeosphaeria Miyake, *J. Coll. agric. Imp. Univ. Tokyo* **2:** 246, 1910.
Dothideopsella Höhnel, *Sber. Akad. Wiss. Wien* **124:** 70, 1915.
Syncarpella Theiss. & H. Sydow, *Annls mycol.* **13:** 631, 1915.
Scleropleella Höhnel, *Annls mycol.* **16:** 158, 1918.
Exilispora Tehon & Daniels, *Mycologia* **19:** 112, 1927.

(Generic synonyms after von Arx & Müller, 1975).

Type sp.: *L. doliolum* (Pers.) Ces & de Not., *Comm. Soc. Critt.Ital.* **1:** 234, 1863.

Anamorphs: *Coniothyrium* Corda, *Diplodina* Westend., *Phaeoseptoria* Speg., *Phoma* Sacc., *Scolecosporiella* Petrak, *Septoria* Sacc., *Stagonospora* (Sacc.) Sacc.

Pseudothecia scattered, immersed becoming erumpent by shedding of host tissue, globose, subglobose, conical, pyriform or hemispherical, distinctly ostiolate. The pseudothecial wall is sclerotioid or composed of more or less uniform thin walled, dark brown cells forming a textura angularis with cells towards the outside more pigmented. Asci thick walled, 8 spored. Ascospores two or more septate, yellowish to yellow brown, somewhat fusoid, with or without gelatinous sheaths, smooth to finely verruculose, straight or curved, usually with one cell wider than the other. Pseudoparaphyses filiform, hyaline, branched.

Müller (1950) and Munk (1957) divided this genus into four separate sections based on pseudothecial characters. Holm (1957) separated *Leptosphaeria* into four genera: *Leptosphaeria* sensu Holm, *Nodulosphaeria* Rabenh., *Phaeosphaeria* Miyake and *Entodesmium* Riess. The separation was based on the substrata and the position of the pseudothecia. Dennis (1978) considered this separation unnatural and maintained these different genera in *Leptosphaeria*. Eriksson (1967b) erected a new genus *Paraphaeosphaeria* for *Leptosphaeria* species with straight punctate ascospores with rounded ends.

Arx & Müller (1975), Eriksson (1967b) and Hedjaroude (1969) accept Holm's division of the traditional *Leptosphaeria* into four different genera. *Phaeosphaeria* occurs on Monocotyledons while *Leptosphaeria* sensu Holm on Dicotyledons. I agree with Dennis (1978) that this division between *Leptosphaeria* and *Phaeosphaeria* based on host substrate is unnatural and place *Phaeosphaeria* as a synonym of *Leptosphaeria*. Genera *Nodulosphaeria, Paraphaeosphaeria* and *Entodesmium* can all be distinctly separated by their pseudothecial and asco-

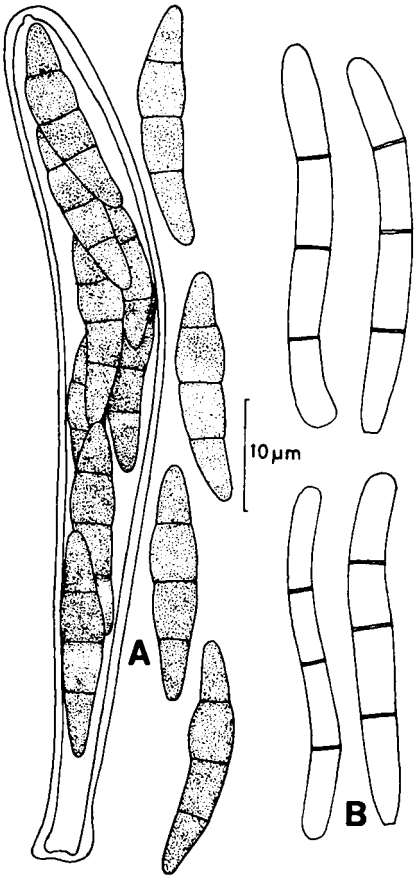


Fig. 262. *Leptosphaeria avenaria.* A, ascus and ascospores; B, conidia.

spore characters. Although most of the *Phaeosphaeria* species have mucilaginous sheaths on the ascospores, this is not a constant character and in at least one species of *Leptosphaeria, L. cylindrospora,* the ends of spores are enclosed in a mucilaginous cushion. (Eriksson, 1967b).

Key to Leptosphaeria species with Septoria anamorph

Conidia 3 septate, 22-30 × 2.5-3 µm, ascospores 3 septate, 19-23 × 3.5-4 µm... ..... *L. nodorum*

Conidia 3 septate, 25-45 × 3-4 µm, ascospores 3 septate, 23-38 × 4.5-6 µm..... ..... *L. avenaria*

L. avenaria Weber, *Phytopathology* **12:** 450, 1922 (Fig. 262).

Phaeosphaeria avenaria (Weber) O. Erikks., *Arkiv Bot.* **6:** 408, 1967.

Anamorph: *Septoria avenae* Frank, *Ber. dt bot. Ges.* **13:** 64, 1895.

Hendersonia avenae (Frank) Petrak, *Sydowia* **1:** 76, 1947.

Pseudothecia up to 130 μm broad. Asci 50-100 × 10-18 μm. Ascospores fusoid, 3 septate, second cell from the top slightly swollen, light yellow to olivaceous, 23-28 × 4.5-6 μm.

Pycnidia up to 150 μm broad. Conidia hyaline, cylindrical, 3 septate, 25-45 × 3-4 μm with an obtuse apex and base, formed on short ob-pyriform, one celled, simple hyaline undifferentiated cells lining the pycnidial cavity.

Spermatia measuring 4-5 × 0.5-1 μm, rod shaped, hyaline, one celled are produced in smaller pycnidia.

On *Avena sativa*. Causing speckle blotch of oats. Worldwide.

The development of pseudothecia has been described by Corlett (1966); the taxonomy and pathology has been dealt with by Shaw (1957) and Sivanesan (1971b), and Johnson (1947, 1952) discussed the cultural variability of forma specialis, *L. avenaria* Weber f. sp. *triticea* with *Septoria avenae* Frank f. sp. *triticea* anamorph which is found on wheat and does not infect oats but is morphologically identical.

L. nodorum E. Müller, *Phytopath. Z.* **19:** 409, 1952 (Fig. 263).

Phaeosphaeria nodorum (E. Müller) Hedjaroude, *Sydowia* **22:** 79, 1969.

Anamorph: *Septoria nodorum* (Berk.) Berk in Berk. & Br., *Ann. Mag. Hist.* II, **5:** 379, 1850.

Depazea nodorum Berk., *Gdnrs' Chron.* **1845:** 601, 1845.
Phoma hennebergii Kuhn., *Fungi europ. exs. Klotzschii Herb. mycol. Cont. Ed. Rabenh. Cent.* 23, No. 2261, 1876.
Macrophoma hennebergii (Kühn.) Berk. & Vogl., *Atti Soc. Ven.-trent. Sci. Nat.* **10:**202, 1886.
Stagonospora hennebergii (Kühn) Petrak & H. Sydow. *Annls mycol.* **23:** 272, 1925.
Hendersonia nodorum (Berk.) Petrak, *Sydowia* **1:** 76, 1947.
Stagonospora nodorum (Berk.) Castellani & Germaño, *Ann.Fac.Sci.agr.Univ. Torino* **10:** 71, 1975-1977.

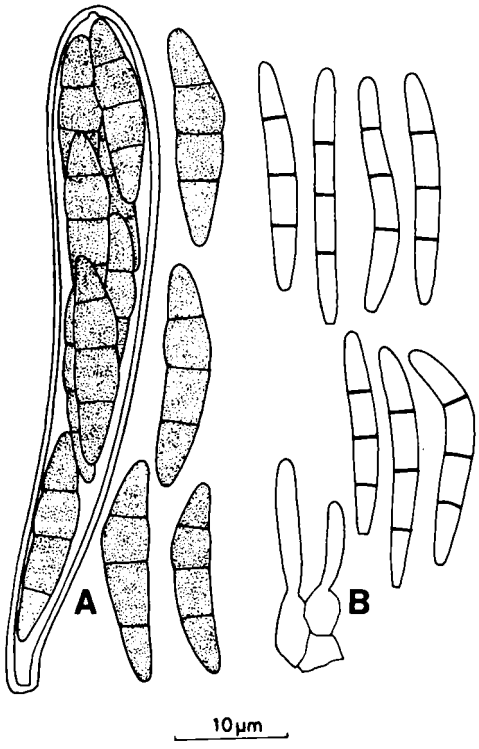


Fig. 263. *Leptosphaeria nodorum.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Pseudothecia up to 200 µm broad with a pseudoparenchymatic wall. Asci 47-65 × 8-10 µm. Ascospores subhyaline to pale brown, 3 septate, constricted at the septa, fusoid, second cell from above swollen, 19-23 × 3.5-4 µm.

Pycnidia immersed, epiphyllous up to 200 µm broad. Conidia hyaline, cylindrical, straight, sometimes curved, mostly 3 septate, ends obtuse 22-30 × 2.5-3 µm formed on short obpyriform, hyaline, simple, one celled undifferentiated inner cells of the pycnidial wall.

On *Triticum* and other genera of *Gramineae.* Causes glume blotch of wheat. Widespread.

Sutton & Waterson (1966) have given a brief account of the biology, pathology and control of this species.

Leptosphaeria species with Phoma anamorph

Phoma Sacc.: Pycnidia immersed, globose to subglobose or obpyriform, pale brown to dark brown, sometimes with long necks, with one central ostiole, sometimes developing more than one ostiole in culture, with a thin wall consisting of thick walled and dark brown cells on the outside and thin walled, subhyaline cells on the inside. Conidiogenous cells hyaline, short, phialidic, enteroblastic, obpyriform, formed from the cells lining the inside of the pycnidium. Conidia hyaline, one celled, occasionally one septate, usually biguttulate, oblong, obovate or ellipsoidal; chlamydospores are often formed in culture.

Key to Leptosphaeria species with Phoma anamorph

Ascospores 1-3 (often 2) septate, 12.5-25 × 3.5-8.5 μm, conidia 4.3-7.2 × 1.4-2.9 μm..... *L. lindquistii*

Ascospores 3 septate..... 1

Ascospores more than 3 septate..... 2

1. Ascospores 15-18 × 5-6 μm, conidia 4-6 × 2-2.5 μm..... *L. solani*

   Ascospores 18-22 × 5.5-7 μm, conidia 5-6.5 × 1.5-2.5 μm..... *L. libanotis*

   Ascospores 18-25 × 3.5-6 μm, conidia 9-14 × 3-5 μm..... *L. sacchari*

   Ascospores 18-27 × 4-7 μm, conidia 5-6 × 2.5-3 μm..... *L. haematites*

   Ascospores 24-33 × 4-5 μm, conidia 4-5.5 × 1.5-2.5 μm..... *L. purpurea*

   Ascospores 13-35 × 4-7 μm, conidia 3-12 × 1.5-3 μm. *L. doliolum* and vars.

   Ascospores 24-32 × 7-8 μm, conidia 4-6 × 1.5-2 μm..... *L. congesta*

   Ascospores 44-52 × 6-7 μm, conidia 3-5.5 × 1-2 μm..... *L. conferta*

2. Ascospores 3-5 septate, 24-30 × 5-6 μm, conidia 3-4 × 2-3 μm..... *L. albopunctata*

   Ascospores 5 or more septate..... 3

3. Ascospores always 5 septate..... 4

   Ascospores more than 5 septate..... 5

4. Ascospores 34-50 × 9-12 μm, conidia 4-6 × 3-5 μm..... *L. spartinae*

   Ascospores 35-70 × 5-8 μm, conidia 3-5 × 1.5-2 μm..... *L. maculans*

5. Ascospores 6 septate, 28-37 × 4-5 μm, conidia 4-5 × 1.5-2 μm.... *L. agnita*

   Ascospores more than 6 septate..... 6

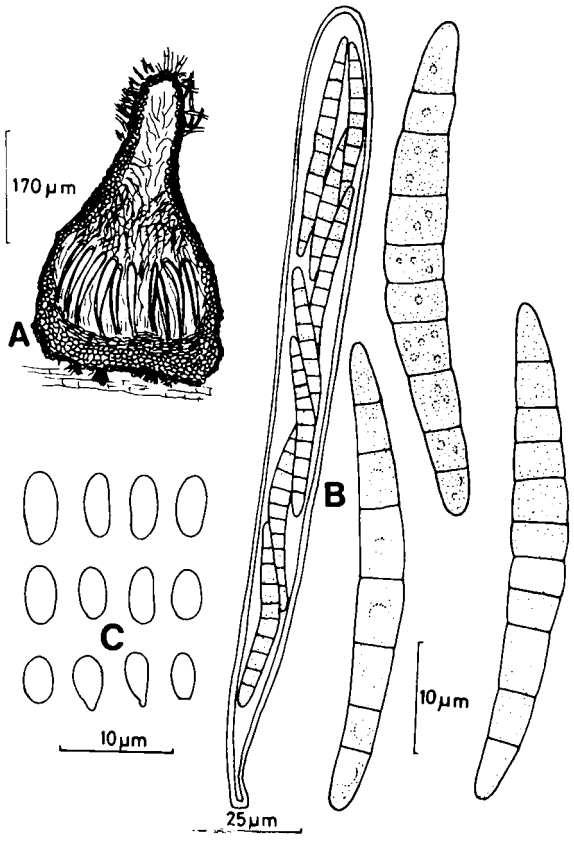


Fig. 264. *Leptosphaeria acuta*. A, v.s. pseudothecium; B, ascus and ascospores; C, conidia.

6. Ascospores 9-10 septate, 40-48 × 10-12 µm, conidia 3-4 × 2.5-3 µm..... ..... *L. typhicola*

   Ascospores 8-13 septate, 37-54 × 4.5-7 µm, conidia 4-5 × 1-2 µm.. *L. acuta*

L. acuta (Fuckel) P. Karsten, *Mycol. Fenn.* **2:** 98, 1873 (Fig. 264).

Pleospora acuta Fuckel, *Symb. mycol.:* 135, 1870.

Anamorph: *Phoma piskorzii* (Petrak) Boerema & Loerakk., *Persoonia* **11:** 315, 1981.

Diploplenodomus piskorzii Petrak, *Annls mycol.* **21:** 123, 1923.

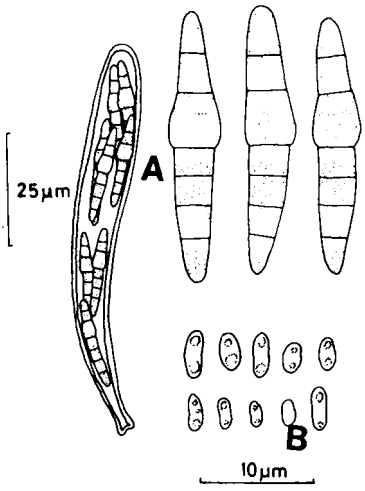


Fig. 265. *Leptosphaeria agnita.* A, ascus and ascospores; B, conidia.

Pseudothecia scattered to gregarious, up to 400 µm broad with a prominent apical ostiole and almost flattened base. Asci 130-140 × 8-10 µm. Ascospores 8-13 (mostly 9-10) septate, scarcely constricted at the septa, yellowish, narrowly fusiform, 37-54 × 4.5-7 µm.

Müller & Tomasevic (1957) obtained a *Phoma* state in culture from ascospore isolates. Conidia hyaline elliptical, one celled, 4-5 × 1-2 µm. Boerema & Loerakker (*loc. cit.* 1981) described the anamorph as *Phoma piskorzii.* On dead stems of *Urtica dioica.* Europe.

L. agnita (Desm.) Ces. & de Not., *Scheme Sfer. Ital. :* 236, 1863 (Fig. 265).

Sphaeria agnita Desm., *Ann. Sci. nat. Bot. ser.* 3, **16:** 313, 1851.

Anamorph: *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia sometimes associated with pale pink colouration of the substrate, solitary or in small groups up to 350 µm broad. Asci 90-120 × 8-10 µm. Ascospores subcylindrical, 6 septate (occasionally 7 septate), third cell from above slightly swollen, straight or slightly curved, yellowish, 28-37 × 4-5 µm.

Pycnidia and pseudothecia produced in culture from single ascospore isolates (Lucas & Webster, 1967). Pycnidia up to 300 µm broad. Conidia hyaline, one celled, biguttulate, 4-5 × 1.5-2 µm.

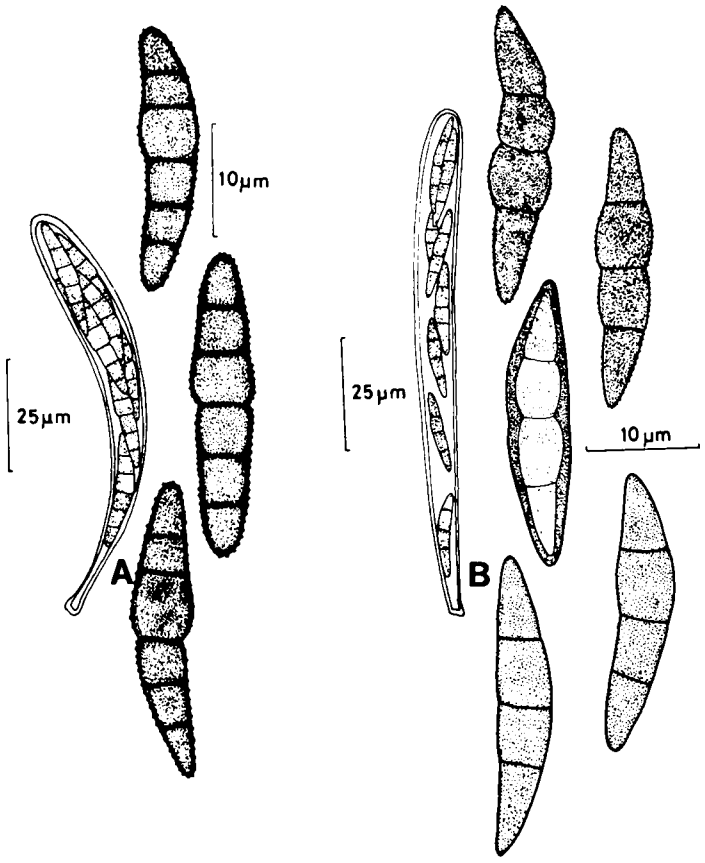


Fig. 266. *Leptosphaeria albopunctata.* A, ascus and ascospores. *L. doliolum.* B, ascus and ascospores.

Usually on stems of *Eupatorium cannabinum* but occurs on many other hosts of different families. India, Europe, Pakistan.

L. albopunctata (Westend.) Sacc., *Syll. Fung.* **2:** 72, 1883 (Fig. 266).

Sphaeria albopunctata Westend. in Kickx, *Pl. Krypt Flandres* **1:** 355, 1867.

Anamorph: *Phoma* sp.

Pseudothecia scattered up to 480 µm broad. Asci 100-190 × 10-30 µm. Ascospores 3-5 (mostly 5) septate, third cell from above swollen, mostly curved, thick walled, brown, 24-30 × 5-6 µm, smooth to punctate (under oil immersion).

Pycnidia globose up to 280 μm broad. Conidia ovoid elliptical to globose, hyaline, one celled, 3-4 × 2-3 μm borne of cylindrical conidiogenous cells.

On culms of *Juncus, Phragmites.* Argentina, Belgium, Canada, Great Britain, U.S.A.

L. conferta Niessl ex Sacc., *Syll. Fung.* **2:** 20, 1883.

Anamorph: *Phoma* sp. (Lucas, 1963).

Pseudothecia up to 380 μm broad, conical to subglobose with a sclerotioid wall. Asci 100-140 × 14-18 μm. Ascospores fusoid, mostly curved, 3 septate, yellowish, guttulate, 44-52 × 6-7 μm.

Pycnidia found associated on host with pseudothecia as well as produced in culture from monoascosporic and monoconidial isolates, up to 380 μm broad. Conidia hyaline, oblong ellipsoidal, biguttulate, 3-5.5 × 1-2 μm.

On dead stems of Cruciferae. Europe.

L. congesta Lucas, *Trans. Br. mycol. Soc.* **46:** 362, 1963.

Anamorph: *Phoma* sp. (Lucas, 1963).

Pseudothecia up to 400 μm broad, aggregated, erumpent with a sclerotioid wall. Asci 92-120 × 12-14 μm. Ascospores rhomboid-fusoid, 3 septate, pale yellowish brown, 24-32 × 7-8 μm.

Pycnidia formed in culture from ascospore isolates but not seen on host, up to 480 μm broad. Conidia hyaline, oblong ellipsoidal, one celled, 4-6 × 1.5-2 μm.

On stems of *Erigeron canadensis.* Portugal.

L. doliolum (Pers.) Ces. & de Not. sub. sp. *doliolum* var. *doliolum* Ces. & de Not., *Comm. Soc. Critt. Ital.* **1:** 234, 1863 (Fig. 266B).

Sphaeria doliolum Pers., *Syn. Meth. Fung.:* 78, 1801.

Anamorph: *Phoma hoehnelii* sub. sp. *hoehnelii* var. *urticae* Boerema & v. Kesteran, *Trans.Br.mycol.Soc.* **67:** 299, 1976.

Phoma herbarum Westend. var. *urticae* Roum. (nomen nudum).

Pseudothecia scattered or aggregated, immersed becoming superficial, globose, papillate, shining black, up to 440 μm broad. Asci 120-160 × 7-8 μm. Ascospores fusoid, 3 septate, slightly constricted at the middle septum, second cell from the apex enlarged, yellowish brown, 20-35 × 4-7 μm.

Pycnidia more or less globose, obpyriform or irregular up to 440 μm broad. Conidia small, one celled, 3-5.5 × 1-2 μm.

On dead stems of *Urtica*. Europe.

Boerema (1976) recognised three varieties of *L. doliolum* based on ascospore and conidial size. The other two varieties are briefly described below.

L. doliolum (Pers.) Ces. & de Not. sub. sp. *doliolum* var. *conoidea* (de Not.) Sacc. *Atti Soc. Veneto-Trent. Sci. nat. Padova* **2:** 53-264, 1873.

Anamorph: *Phoma hoehnelii* v. Kesteren sub. sp. *hoehnelii* var. *hoehnelii, Neth. J. Pl. Path.* **78:** 116, 1972.

Pseudothecia depressed globose or conical, papillate, up to 600 μm broad. Ascospores 16-26 × 3-6 μm.

Pycnidia up to 440 μm broad. Conidia 3-5.5 × 1-2 μm, similar to those of var. *doliolum* but pycnidial development in culture progresses more quickly than it does in var. *doliolum*. Plurivorous.

L. doliolum (Pers.) Ces. & de Not. sub. sp. *pinguicula* Sacc., *Michelia* **2:** 598, 1882.

Anamorph: *Phoma hoehnelii* v. Kesteren sub. sp. *amplior* (Sacc. & Roum.) Boerema & v. Kesteren, *Trans. Br. mycol. Soc.* **67:** 299. 1976.

Phoma acuta Fuckel sub. sp. *amplior* Sacc. & Roum., *Rev. Mycol.* **6:** 30, 1884.

Pseudothecia depressed globose or conical, papillate, up to 500 μm broad. Ascospores usually 13-25 × 5-7 μm.

Pycnidia up to 500 μm broad. Conidia relatively large, 4-7.5(12) × 1.5-3 μm, sometimes becoming one septate.

Pluvivorous, originally described from stems of *Foeniculum*.

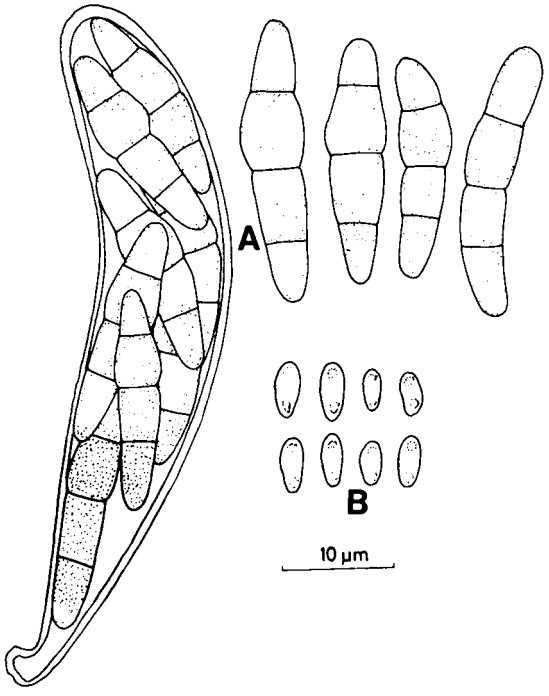


Fig. 267. *Leptosphaeria haematites.* A, ascus and ascospores; B, conidia.

L. haematites (Rob. ex Desm.) Niessl in Rabenh., *Hedwigia* **22:** 10, 1883 (Fig. 267).

Sphaeria haematites Rob. ex Desm., *Ann. Sci. Nat. ser* 3, **16:** 311, 1851.
Didymella haematites (Rob. ex Desm.) Sacc., *Syll. Fung.* **1:** 553, 1882.
Sphaerella haematites (Rob. ex Desm.) Cooke, *J. Bot.* **21:** 109, 1883.

Anamorph: *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia up to 420 µm broad, densely gregarious. Asci 70-125 × 8-10 µm. Ascospores ellipsoidal, 3 septate, constricted at the middle, yellowish, second cell from above swollen, 18-27 × 4-7 µm.

Pycnidia formed in cultures derived from single ascospore isolates, up to 150 µm broad. Conidia hyaline, oblong, elliptical or ovoid, one celled 5-6 × 2.5-3 µm.

On dead stems of *Clematis vitalba* and *Eupatorium.* India, Europe.

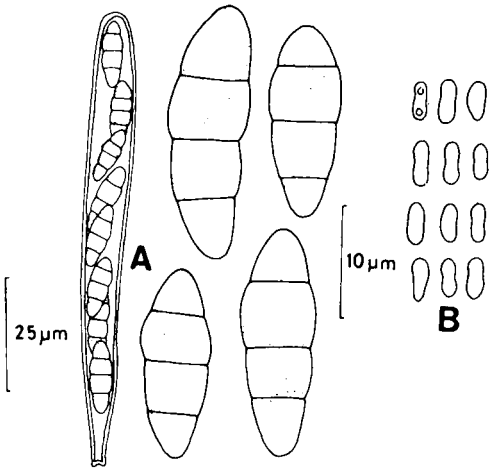


Fig. 268. *Leptosphaeria libanotis.* A, ascus and ascospores; B, conidia.

L. libanotis (Fuckel) Niessl in Kunze, *Fung. Ser. No.* 75, 1876 (Fig. 268).

Pleospora libanotis Fuckel, *Symb. mycol.* **2:** 24, 1873.
Metasphaeria angelicae Rostr., *Bot. Tiddskr.* **25:** 306, 1903.

Anamorph: *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia up to 420 μm broad, with a scleroplectenchymatic wall. Asci 100-125 × 8-10 μm. Ascospores ellipsoidal, 3 septate, constricted at the middle, second cell from above swollen, yellowish, 18-22 × 5.5-7 μm.

Pycnidia formed in culture from monoascosporic isolates, up to 320 μm broad (Lucas & Webster, 1967). Conidia hyaline, oblong, bi-guttulate, 5-6.5 × 1.5-2.5 μm.

On dead stems of *Angelica sylvestris, Daucus carota, Seseli libanotis, S. osseum, S. varium.* Europe.

L. lindquistii Frezzi, *Rev. Inst. Agrop. Ser.* **5,** 5: 79, 1968.

Anamorph: *Phoma macdonaldii* Boerema, *Persoonia* **6:** 20, 1970.

Pseudothecia immersed, up to 230 μm broad. Asci 70-145 × 7.5-10.5 μm. Ascospores hyaline, fusiform, 1-3 (often 2) septate, constricted at the septa, 12.5-25 × 3.5-8.5 μm.

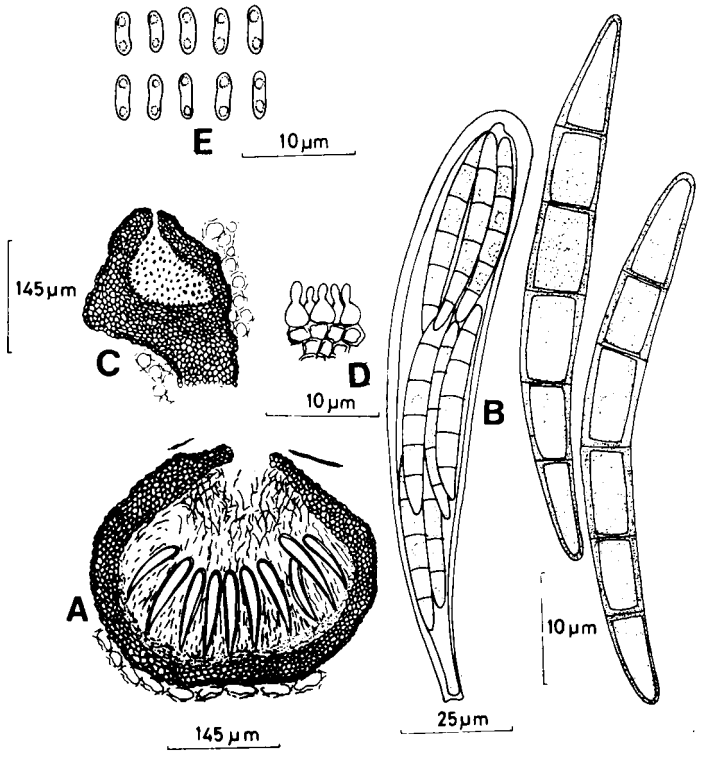


Fig. 269. *Leptosphaeria maculans.* A, v.s. pseudothecium; B, ascus and ascospores; C, v.s. pycnidium; D, conidiogenous cells; E, conidia.

Pycnidia subglobose, up to 308 µm broad. Conidia hyaline, one celled, oblong to reniform, ends obtuse, 4.3-7.2 × 1.4-2.9 µm.

On leaves, petioles, stems and inflorescence of *Helianthus annuus.* Argentina. Causes the 'black stem' disease of sunflower. (McDonald, 1964).

L. maculans (Desm.) Ces. & de Not., *Comm.Soc.Critt. Ital.* **1:** 235, 1863 (Fig. 269).

Sphaeria maculans Desm., *Ann. Sci. nat.* **6:** 77, 1846.
Pleospora maculans (Desm.) Tul., *Sel. Fung. Carp.* **2:** 274, 1863.

Anamorph: *Phoma lingam* (Tode: Fr.) Desm., *Ann. Sci. nat. ser.* 3, **11:** 281, 1849.

Sphaeria lingam Tode, *Fung. Mecklenb. Sel.* **2:** 51, 1791.
Sphaeria lingam Tode: Fr., *Syst. mycol.* **2:** 507, 1823.
Depazea brassicaecola Desm., *Exs. Pl. Crpyt. N. France, Ed. 1* No. 185, 1826.
Sclerotium sphaeriaeforme Lib., *Exs. Pl. Crypt. Ard. No.* 237, 1834.
Depazea vagans ("Y") *brassicae* Kickx, *Fl.-Crypt. Env. Louv.:* 125, 1835.
Septoria brassicae Westend. & Wall., *Exs. Herb. Crypt. Belge.* No. 294, 1847.
Phyllosticta brassicae Westend., *Bull. Acad. Belg. Cl. Sci.* **10:** 397, 1851.
Plenodomus rabenhorstii Preuss, *Linnaea* **24:** 145, 1851.
Aposphaeria brassicae Thüm., *Hedwigia* **12:** 189, 1880.
Phoma brassicae (Thüm.) Sacc., *Syll. Fung.* **3:** 119, 1884.
Phoma napobrassicae Rostr., *Tiddskr. Landkon* **11:** 330, 1892.
Plenodomus lingam (Tode: Fr.) Höhnel, *Sber. Akad. Wiss. Wien* **120:** 463, 1911.
Phoma lingam (Tode: Fr.) Desm. var. *naprobrassicae* (Rostr.) Grove, *Brit. Coelomycetes* **1:** 70, 1935.

Pseudothecia up to 500 μm broad. Asci 80-130 × 15-22 μm. Ascospores cylindrical to ellipsoidal, yellow brown, 5 septate, not or slightly constricted at the septum, guttulate, 35-70 × 5-8 μm.

Pycnidia of two types. A sclerotioid form which is immersed to erumpent, variable in shape, convex to depressed concave up to 500 μm broad with a wall of several layers of thick walled sclerenchymatous cells and the other type globose up to 600 μm broad with the wall composed of several layers of cells being thick walled at the outermost layer. Conidia hyaline, one celled, biguttulate, straight or curved, cylindrical, 3-5 × 1.5-2 μm.

On *Brassica.* Causing disease variously known as canker, dry rot and black leg. Other Cruciferous genera are also attacked. Widespread.

L. purpurea Rehm, Ascom. *Lojkani lecti:* 54, 1882 (Fig. 270).

Melanomma purpureum (Rehm) L. Holm, *Symb. Bot. Upsal.* **14:** 64, 1957.

Anamorph: *Phoma sanguinolenta* Grove, *J. Bot. Lond.* **23:** 162, 1885.

Phoma rubella Grove, *J. Bot. Lond.* **23:** 162, 1885.

Pseudothecia gregarious subepidermal, below reddened or purple coloured patches of the host, up to 530 μm broad. Asci 74-100 × 7-10 μm. Ascospores fusoid, 3 septate, second cell from above swollen, yellowish to yellow brown, 24-33 × 4-5 μm.

Pycnidia obtained in culture from single ascospore isolates by Lucas & Webster (1967) as well as found on host, up to 400 μm broad. Conidia oblong, hyaline, one celled, biguttulate, 4-5.5 × 1.5-2.5 μm.

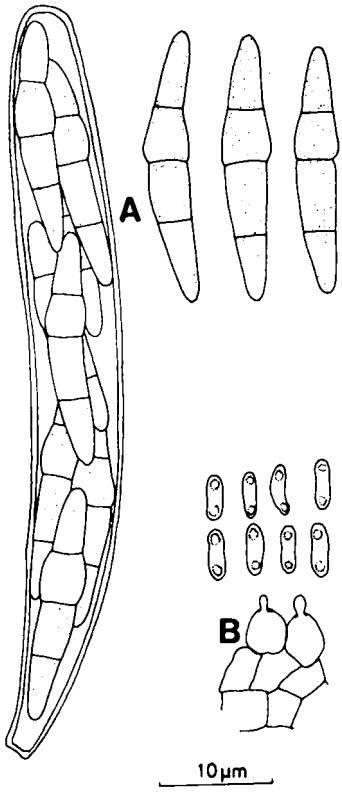


Fig. 270. *Leptosphaeria purpurea*. A, ascus and ascospores; B, conidiogenous cells and conidia.

On *Artemisea vulgaris, Betonica officinalis, Carduus crispus, Chamaenerion angustifolium, Cirsium arvense, C. vulgare, Senecio nemorensis, Satureja* spp. (Compositae). Europe.

L. sacchari van Breda de Haan, *Meded. Proefstat. Suikerr. W. Java* **3:** 25, 1892 (Fig. 271).

Anamorph: *Phoma* sp. (described as *Phyllosticta* sp., Hudson, 1960).

Pseudothecia up to 140 µm broad. Asci 60-75 × 9-13 µm. Ascospores ellipsoidal, hyaline to subhyaline, 3 septate, second cell from above slightly swollen, guttulate, 18-25 × 3.5-6 µm.

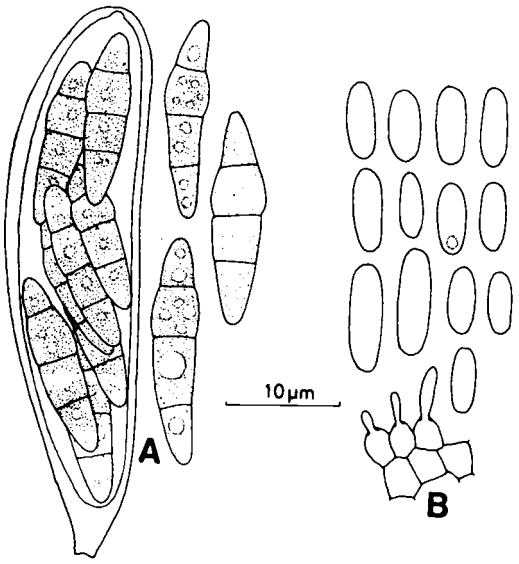


Fig. 271. *Leptosphaeria sacchari.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Pycnidia found on host as well as formed in culture from monoascosporic cultures (Hudson, 1960), up to 100 µm broad. Conidia hyaline, pale brown in mass, one celled, ellipsoidal to subfusoid, 9-14 × 3-5 µm formed on hyaline, enteroblastic, simple, one celled, cylindrical conidiogenous cells.

On *Saccharum.* Causes ring spot of sugar cane leaves. Africa, Asia, S. America.

L. solani Romell in Berl., *Icon. Fung.* **1:** 63, 1894 (Fig. 272).

Melanomma solani (Romell) L. Holm. *Symb. Bot. Upsal.* **14:** 56, 1957.
Leptosphaeria opizii Nitschke in Schroeter, *Die Pilze Schlesien 2:* 358, 1894.

Anamorph: *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia scattered, up to 320 µm broad. Asci 76-100 × 8-9 µm. Ascospores fusoid, 3 septate, second cell from above swollen, olive green, ends obtuse, 15-18 × 5-6 µm.

Pycnidia produced in culture from single ascospore isolates by Lucas & Webster (1967) up to 500 µm broad. Conidia hyaline, one celled,

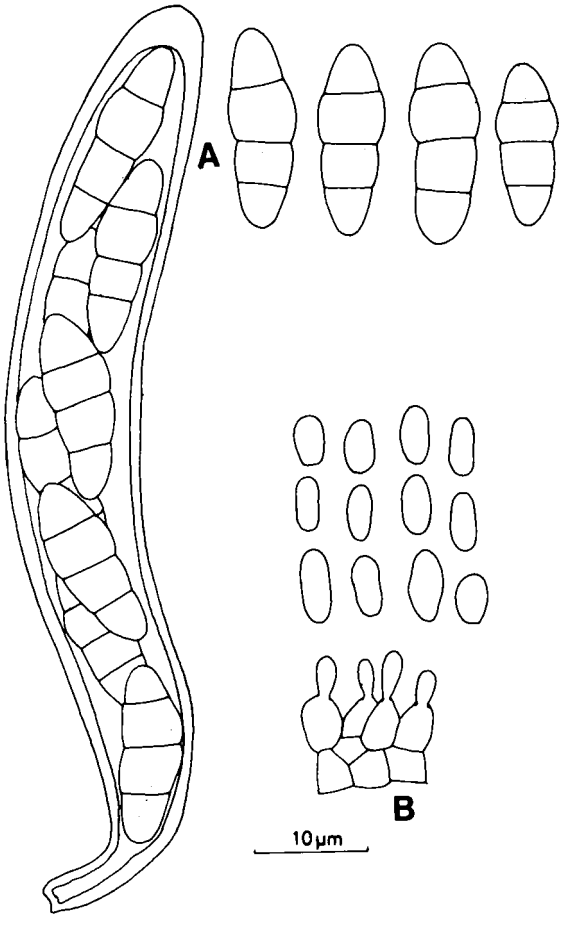


Fig. 272. *Leptosphaeria solani.* A, ascus and ascospores; B, conidiogenous cells and conidia.

oblong, ellipsoidal or ovoid, 4-6 × 2-2.5 µm formed on phialidic structures lining the cavity of the pycnidium.

On *Solanum dulcamara*. Europe.

L. spartinae Ell. & Ev., *J. Mycol.* **1:** 43, 1885 (Fig. 273).

Anamorph: *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia solitary or in rows, up to 300 µm wide. Asci 160-210 × 17-20 µm. Ascospores broadly fusoid, 5 septate, middle cells larger than the

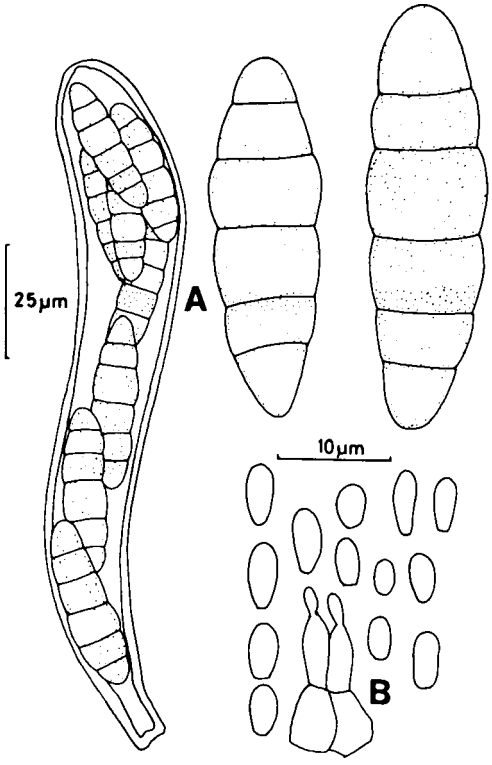


Fig. 273. *Leptosphaeria spartinae*. A, ascus and ascospores; B, conidiogenous cells and conidia.

others, slightly constricted at the septa, end cells obtuse, yellowish 34-50 × 9-12 µm.

Pycnidia derived in culture from monoascosporic and monoconidial isolates as well as found on host, up to 360 µm broad. Conidia one celled, ellipsoidal, globose to ovoid, yellowish, 4-6 × 3-5 µm.

On *Spartina townsendii*. Great Britain, U.S.A.

Johnson (1956) regards *L. spartinae* as a synonym of *L. albopunctata* Westend but the ascospores in the latter species are much narrower and not as long in *L. spartinae*. The ascospores in *L. albopunctata* are also finely punctate under oil immersion.

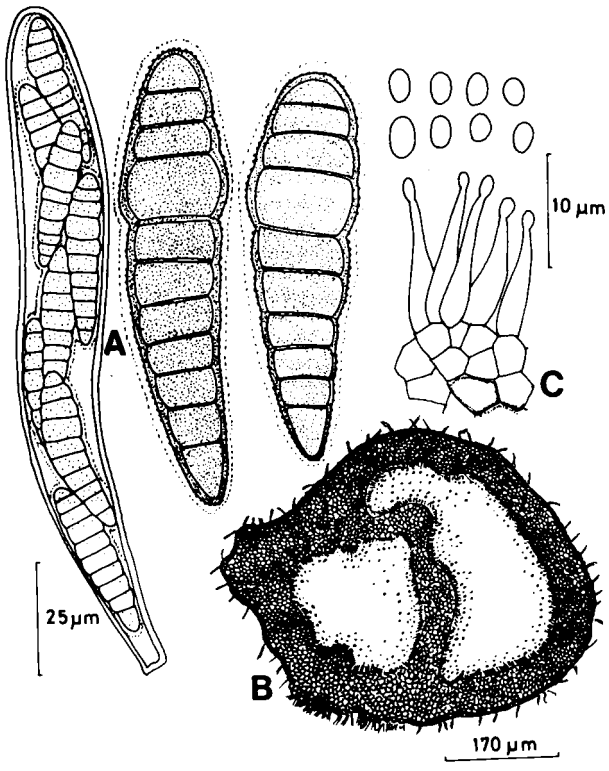


Fig. 274. *Leptosphaeria typhicola.* A, ascus and ascospores; B, v.s. pycnidium; C, conidiogenous cells and conidia.

L. typhicola P. Karsten, *Mycol. Fenn.* **2:** 100, 1873 (Fig. 274).

Phaeosphaeria typhicola (P. Karsten) Hedjaroude, *Sydowia* **22:** 86, 1969.

Anamorph: *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia up to 300 µm broad. Asci 120-140 × 19-24 µm. Ascospores navicular, 9-10 septate, fourth cell from above swollen, with a mucilaginous sheath, 40-48 × 10-12 µm.

Monoascosporic isolates produced pycnidia (Lucas & Webster, 1967) up to 400 µm broad. Conidia spherical, ovoid or elliptical, hyaline, one celled, 3-4 × 2.5-3 µm.

On culms of *Juncus, Phragmites, Spartina.* Argentina, Finland, Great Britain, U.S.A.

Scolecosporiella Petrak: Pycnidia immersed, septate, unilocular, brown, globose, ostiolate. Conidiogenous cells holoblastic, ampulliform to doliiform, hyaline formed from the inner cells of the pycnidial wall. Conidia pale brown, 3 or more septate, sometimes with vertical septa, fusiform, apical cell tapered to a short or long filiform, simple-cellular tip, base truncate and thin-walled (Sutton, 1980).

Key to Leptosphaeria species with Scolecosporiella anamorph

Ascospores 3 septate, 25-40 × 4.5-6 μm, conidia 5-7 septate, 60-120 × 2.5-5 μm ..... *L. macrospora*

Ascospores 3 septate, 20-33 × 9-13 μm, conidia 5-8 septate, 50-90 × 7-9 μm.... ..... *L. typharum*

L. macrospora (Fuckel) Thüm., *Hedwigia* **21:** 83, 1882 (Fig. 275).

Pleospora macrospora Fuckel, *Symb. Mycol:* 138, 1870.
Leptosphaeria nitschkei Rehm in *Winter, Fl.* **55:** 510, 1872.
Metasphaeria macrospora (Fuckel) Sacc., *Syll. Fung.* **2:** 158, 1883.

Anamorph: *Scolecosporiella bernardiana* (Sacc.) comb. nov.

Rhabdospora bernardiana Sacc., *Nuova G. bot. Ital.* **24:** 41, 1917.

According to Lucas & Webster (1967) it is a *Urohendersoniella* sp. like the anamorph of *Ophiobolus herpotrichus*. Sutton (1980) has placed *Urohendersoniella* as a synonym of *Scolecosporiella*.

Pseudothecia solitary or gregarious, up to 400 μm broad. Asci 80-120 × 11-13 μm. Ascospores fusoid, 3 septate, second cell from above markedly swollen, pale yellow brown, pointed at the ends, 25-40 × 4.5-6 μm.

Pycnidia derived in culture from monoascospore isolates (Müller, 1953; Lucas & Webster, 1967), up to 300 μm broad with long necks. Conidia cylindrical, rounded at the base, 5-7 septate, guttulate, hyaline to pale brown, tapering to a filamentous apex, 60-120 × 2.5-5 μm.

On stems of *Adenostyles alliaria, Cirsium spinosissimum, Prenanthes purpurea, Rumex acetosa, R. alpinus, Senecio nemorensis*. Europe.

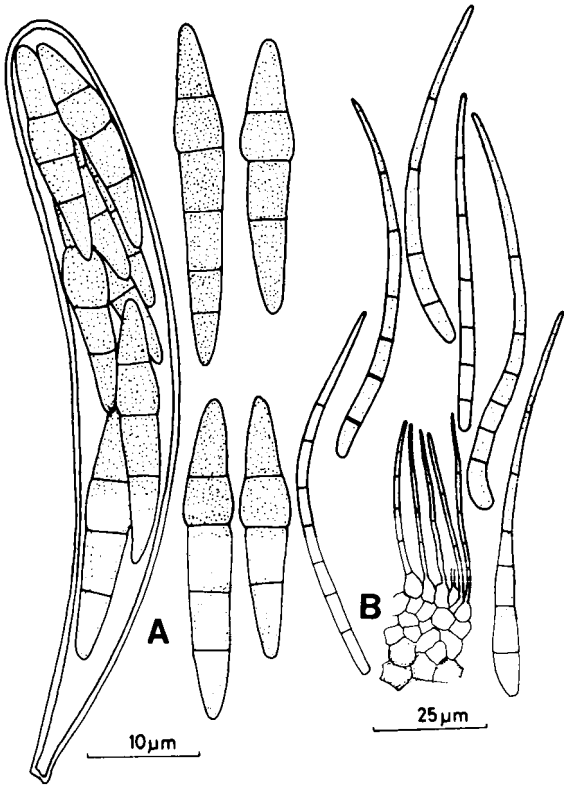


Fig. 275. *Leptosphaeria macrospora.* A, ascus and ascospores; B, conidiogenous cells and conidia.

L. typharum (Desm.) P. Karsten, *Mycol. Fenn.* **2:** 100, 1873 (Fig. 276).

Phaeosphaeria typharum (Desm.) L. Holm, *Symb. Bot. Upsal.* **14:** 126, 1957.

Anamorph: *Scolecosporiella typhae* (Oudem.) Petrak, *Annls mycol.* **19:** 31, 1921.

Hendersonia typhae Oudem., *Arch. neerl. Sci.* **8:** 361, 1873.
Scolicosporium typhae (Oudem.) Höhnel, *Sber. Akad. Wiss. Wien* **118:** 405, 1909.
Hendersonia typhae Oudem. var. *major* Grove, *J. Bot. Lond.* **56:** 317, 1918.

Pseudothecia solitary to gregarious, up to 160 µm broad. Asci 70-100 × 20-26 µm. Ascospores broadly ellipsoidal, brown, 3 septate, second cell from above swollen, 20-33 × 9-13 µm.

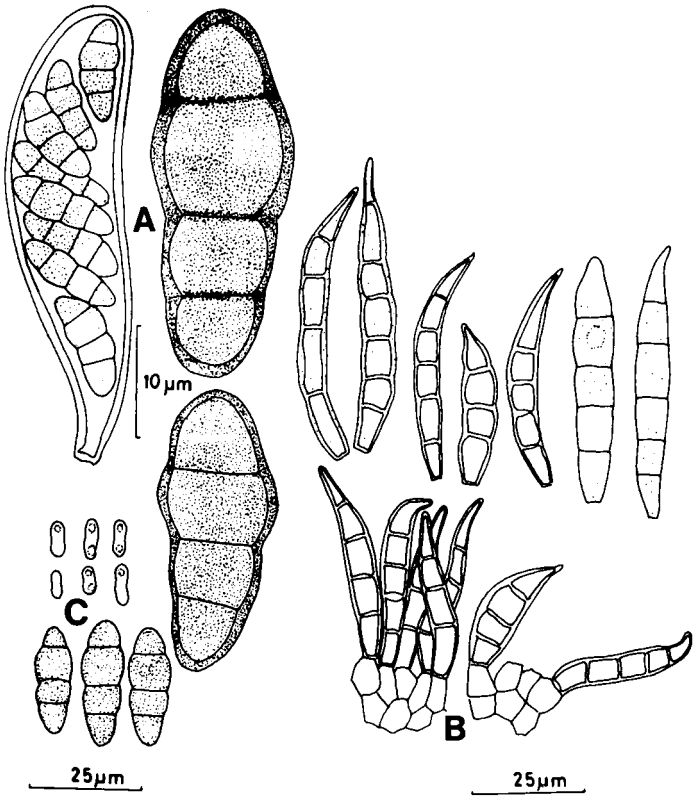


Fig. 276. *Leptosphaeria typharum*. A, ascus and ascospores; B, conidiogenous cells and conidia; C, spermatia.

Pycnidia unilocular, up to 150 µm broad. Conidia cylindrical to obclavate, pale brown, 5-8 septate, smooth, constricted at the septa, tapering to an elongated cellular tip, 50-90 × 7-9 µm.

Phoma typhae Oudem. is always associated with this species and is presumed to be the spermogonial state. Webster (1955b) has described in detail the anamorph of this species. On *Typha*. India, Europe, U.S.A.

Leptosphaeria species with Stagonospora and with or without Phoma anamorphs.

Stagonospora (Sacc.) Sacc.: Pycnidia immersed, unilocular, globose, separate, ostiolate, thick-walled, with walls on the outside of dark

brown, thick-walled textura angularis and on the inside of hyaline thin-walled smaller cells. Conidiogenous cells holoblastic, sometimes annellidic, doliiform, hyaline, formed from the inner cells of the pycnidial wall. Conidia hyaline, smooth rarely distantly and finely verruculose, multiseptate, cylindrical or fusiform, straight or slightly curved, often guttulate, constricted or not constricted at the septa (Sutton, 1980).

Key to Leptosphaeria species with Stagonospora anamorph

Ascospores 1-3 septate..... 1

Ascospores 3 or more septate..... 6

1. Ascospores up to 22 μm long..... 2

   Ascospores often more than 22 μm long..... 3

2. Ascospore 18-22 × 3-4.5 μm, *Stagonospora* conidia 3-7 septate, 13-18 × 2.5-3 μm..... *L. eustomoides*

   Ascospores 19-21 × 5-6 μm, conidia 1-3 septate, 8-20 × 2.5-3 μm..... *L. pratensis*

3. Ascospores more than 26 μm long..... 4

   Ascospores less than 26 μm long..... 5

4. Ascospore second cell swollen and distinctly dark brown, 29-42 × 8-11 μm, conidia 2-3 septate, 21-34 × 7-11.5 μm *(Stagonospora)*..... *L. bicolor*

   Ascospore second cell not swollen and not distinctly dark brown, 40-46 × 6.5-12 μm, conidia 1-3 septate, 28-40 × 11.5-16 μm. *(Stagonospora)*..... *L. taiwanensis*

5. Ascospores 16-25 × 4.5-5 μm, conidia 1-5 septate, 18-30 × 3-4 μm..... *L. viridella*

   Ascospores 20-24 × 3-3.5 μm, conidia 1-3 septate, 14-32 × 2-3 μm..... *L. dumetorum*

6. Ascospores 6 septate, 27-34 × 3.5-5.5 μm, conidia mostly 3 septate, 20-30 × 2-4 μm..... *L. anemones*

   Ascospores 8-12 septate, 32-50 × 4-5 μm, conidia 3-5 septate, 18-32 × 2-4 μm..... *L. pontiformis*

L. anemones Hollos, *Annls. Mus. nat. Hung.* **4:** 334, 1906 (Fig. 277).

Anamorph: *Stagonospora anemones* Pat., *Rev. Mycol.* **8:** 181, 1886.

Rhabdospora anemones Hollos, *Annls. Mus. nat. Hung.* **4:** 335, 1906.

Pseudothecia up to 300 μm broad. Asci 70-100 × 8-10 μm. Ascospores

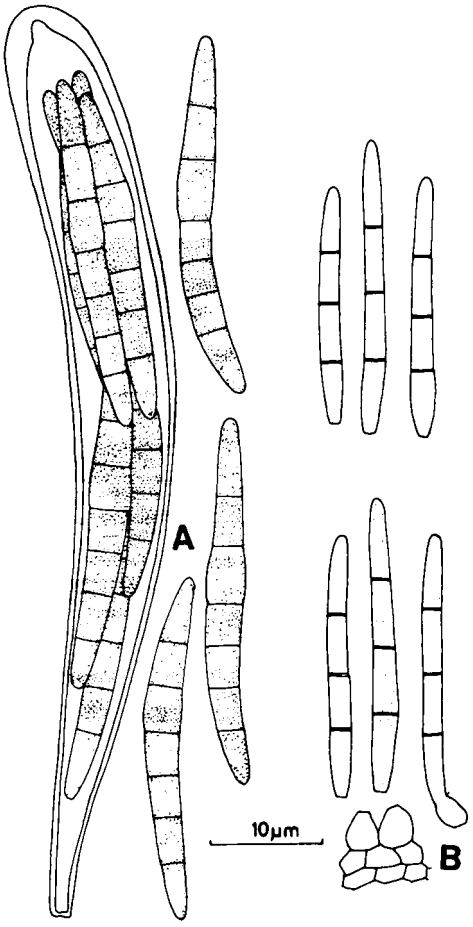


Fig. 277. *Leptosphaeria anemones*. A, ascus and ascospores; B, conidiogenous cells and conidia.

6 septate, third cell from above swollen, somewhat constricted at the septa, 27-34 × 3.5-5.5 µm.

Pycnidia on host as well as produced in culture from ascospore isolates (Müller, 1950) up to 300 µm broad. Conidia elongate cylindric, mostly 3 septate, hyaline to yellow, ends rounded straight or curved, 20-30 × 2-4 µm broad.

On stems and petioles of *Anemone alpina, A. narcissiflora*. Europe.

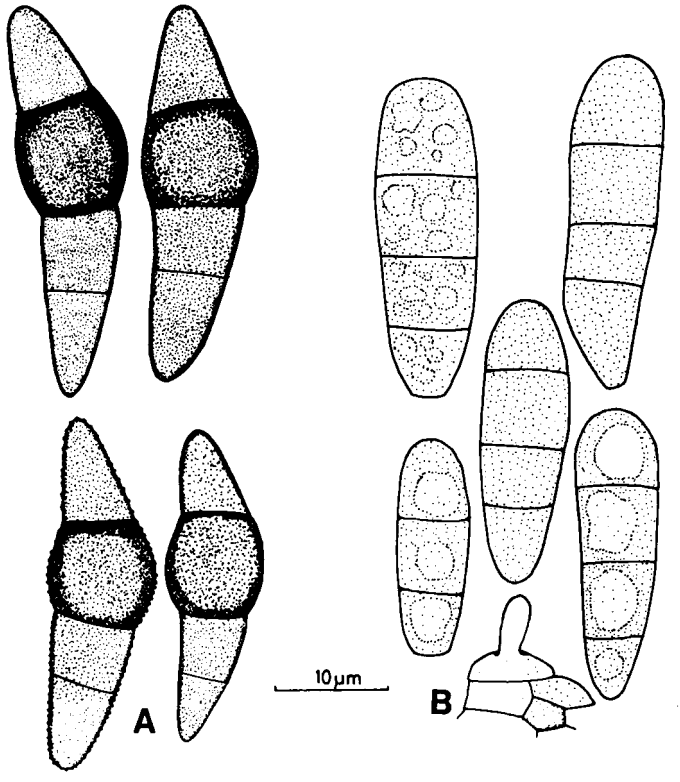


Fig. 278. *Leptosphaeria bicolor* (type). A, ascospores; B, conidiogenous cell and conidia.

L. bicolor Kaiser, Ndimande & Hawksw., *Mycologia* **71:** 483, 1979 (Fig. 278).

Anamorph: *Stagonospora* sp.

Pseudothecia up to 220 µm broad. Asci 125-150 × 25-30 µm. Ascospores fusiform, (2-)3 septate, second cell from above swollen and dark brown, other cells pale brown to subhyaline, smooth to slightly roughened, not or markedly constricted at the septa, 29-42 × 8-11 µm.

Pycnidia on host and produced in pure culture mixed together up to 250 µm broad. Conidia hyaline, smooth, ellipsoidal, ends somewhat truncate, 2-3 septate, often guttulate, not or slightly constricted at the septa, 21-34 × 7-11.5 µm formed singly in smooth, hyaline holoblastic, minute, mammiform conidiogenous cells with flattened apex lining the inside of the pycnidial wall.

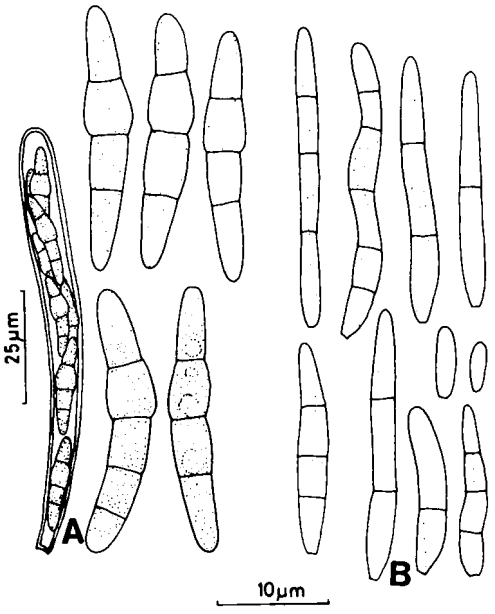


Fig. 279. *Leptosphaeria dumetorum.* A, ascus and ascospores; B, conidia.

On leaves of *Saccharum.* Kenya. It causes leaf-scorch disease of sugarcane.

L. dumetorum Niessl, *Verh. naturf. Ver. Brünn.* **10:** 176, 1871 (Fig. 279).

Anamorphs: *Stagonospora* (as *Hendersonia)* and *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia up to 320 µm broad. Asci 70-85 × 7-10 µm. Ascospores cylindric-fusoid, 3 septate, second cell from above swollen, yellowish, 20-24 × 3-3.5 µm, end cells obtuse.

Isolates derived from single ascospores produced two types of pycnidia in culture media (Lucas & Webster, 1967). *Stagonospora* pycnidia up to 400 µm broad. Conidia obclavate, pale brown, 1-3 septate, 14-32 × 2-3 µm. *Phoma* pycnidia smaller. Conidia oblong to elliptical, hyaline, biguttulate, 6-9 × 2.5-3 µm.

Niessl (1871) has described a spermogonia containing spores measuring 2-4 × 0.25-0.5 µm.

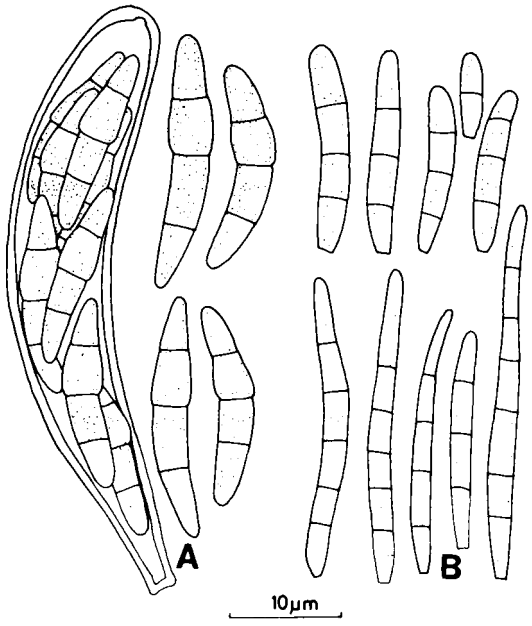


Fig. 280. *Leptosphaeria eustomoides*. A, ascus and ascospores; B, conidia.

On *Atropa, Carduus, Lonicera, Oenothera, Ranunculus, Urtica dioica*. Europe.

L. eustomoides Sacc., *Nuovo. G. bot. Ital.* 7: 319, 1875 (Fig. 280).

Anamorph: *Stagonospora* sp. (as *Hendersonia*) (Webster & Hudson, 1957).

Pseudothecia up to 190 µm broad. Asci 60-80 × 6-8 µm. Ascospores fusoid, yellowish brown, 3 septate, somewhat constricted at the septa, second cell from above swollen, end cells acute 18-22 × 3-4.5 µm.

Pycnidia found in host as well as derived from monoascosporic isolates (Webster & Hudson, 1957). Conidia pale brown, obclavate, truncate at the base tapering to an obtuse apex, commonly 3 septate, 13-18 × 2.5-3 µm, but in culture they may become up to 7 septate and measure 18-40 × 2-3.5 µm.

On various graminicolous hosts. Cosmopolitan.

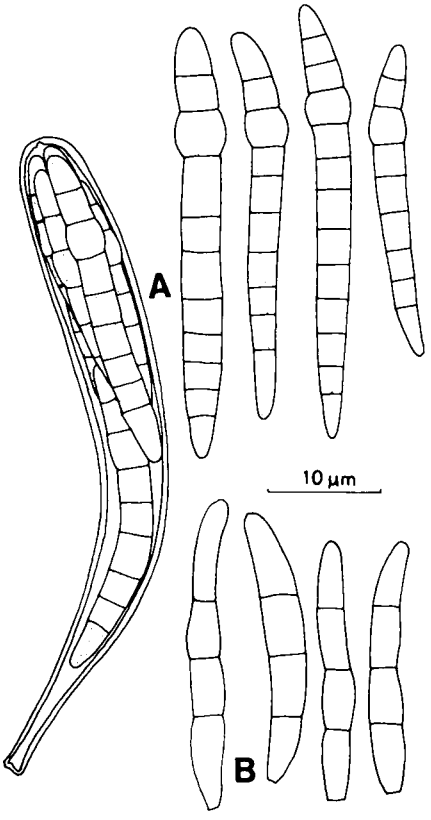


Fig. 281. *Leptosphaeria pontiformis.* A, ascus and ascospores; B, conidia.

L. pontiformis (Fuckel) Sacc., *Syll. Fung.* **2:** 78, 1883 (Fig. 281).

Pleospora pontiformis Fuckel, *Symb. mycol.:* 139, 1870.

Anamorph: *Stagonospora* (as *Hendersonia*) and *Phoma* types (Webster & Hudson, 1957).

Pseudothecia scattered or in rows, up to 250 µm broad. Asci 90-135 × 10-16 µm. Ascospores cylindrical, straight or curved, pale yellow, 8-12 (commonly 10) septate, third or fourth cell from above swollen, ends obtuse, occasionally constricted at the septa, 32-50 × 4-5 µm.

Ascospore isolates produced both *Stagonospora* and *Phoma* type of anamorphs (Webster & Hudson, 1957). *Stagonospora* pycnidia up to 300 µm broad. Conidia narrowly obclavate, pale brown, smooth to

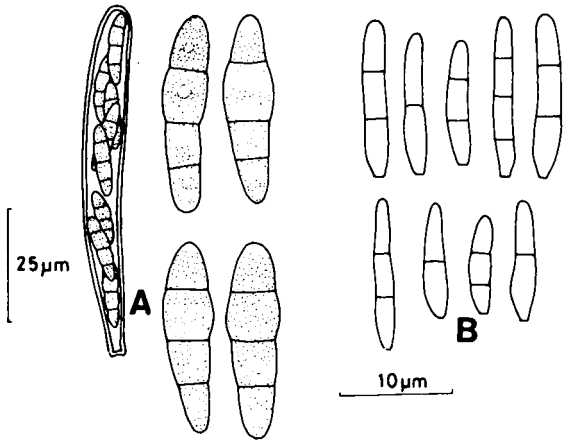


Fig. 282. *Leptosphaeria pratensis*. A, ascus and ascospores; B, conidia.

finely verruculose under oil immersion, straight or slightly curved, 3-5 (usually 3) septate, not constricted at the septa, 18-32 × 2-4 µm. *Phoma* pycnidia up to 800 µm broad, often multilocular, 3.5-6 × 1 µm formed on tapering phialides lining the cavity of the pycnidium.

On *Agropyron* and other grasses. Europe.

L. pratensis Sacc. & Briard. in Briard., *Rev. mycol.* **7:** 209, 1885 (Fig. 282).

Leptosphaeria dumetorum Niessl f. *meliloti* Rehm, *Hedwigia* **22:** 56, 1883.
Leptosphaeria meliloti Hollos, *Math. Termesz. Kolzm. Magy. Acad.* **35:** 33, 1926.

Anamorphs: *Stagonospora* and *Phoma* sp. (Lucas & Webster, 1967).

Pseudothecia up to 450 µm broad. Asci 80-100 × 9-10 µm. Ascospores fusoid, 3 septate, second cell from above swollen, end cells obtuse, yellowish, 19-21 × 5-6 µm.

Pycnidia of *Stagonospora* and *Phoma* types were produced in culture as well as found on host (Lucas & Webster, 1967; Jones & Weimer, 1938). *Stagonospora* conidia cylindrical, truncate at the base, tapering to a rounded apex, hyaline, 1-3 septate, 8-20 × 2.5-3 µm.

Phoma conidia oblong, elliptical, hyaline, one celled, 4-6 × 2-3 µm. Jones & Weimer (1938) determined the anamorphs as *Stagonospora meliloti* (Lasch) Petrak and *Phoma meliloti* Allescher.

On *Medicago sativus, Melilotus albus, M. officinalis, Ulex europaeus*. Europe, U.S.A.

L. taiwanensis Yen & Chi, *J. Sugarcane Res.* **6:** 213, 1952.

Anamorphs: *Stagonospora tainanensis* Hsieh, *Mycologia* **71:** 893, 1979 and *Phoma* sp. (Hsieh, 1979).

Pseudothecia amphigenous, up to 150 μm in narrow elliptical to elongate streaks. Asci 60-115 × 20-33 μm. Ascospores oblong fusoid, hyaline to brown, 3 septate, constricted at the septa, 40-46 × 6.5-12.5 μm.

Both types of pycnidia were isolated from monoconidial and mono ascosporic cultures. *Stagonospora* pycnidia globose to subglobose, up to 195 μm broad, ostiolate. Conidia hyaline, straight or curved, 1-3 (mostly 3) septate, rounded to truncate, attenuating to a rounded base, guttulate, 28-40 × 11.5-16 μm formed on short conidiogenous cells. *Phoma* conidia hyaline, one celled, biguttulate, ovoid to rod shaped, straight to slightly curved, 4.4-13 × 2-5 μm formed on undifferentiated hyaline cells lining the inside of the pycnidium.

On leaves and leaf sheaths of *Saccharum officinarum*. Taiwan. Causes leaf blight of sugarcane.

Cercospora taiwanensis Yen & Chi was erroneously attributed as the anamorph of this species until Hsieh (1979) proved the genetic connection between the *Stagonospora* and *Leptosphaeria* state.

L. viridella (Peck) Sacc., *Syll. Fung.* **2:** 18, 1883 (Fig. 283).

Sphaeria viridella Peck, *Rep. N. Y. St. Mus.* **30:** 66, 1878.

Anamorph: *Stagonospora* sp. (as *Hendersonia)*

Pseudothecia solitary, up to 240 μm broad. Asci 72-80 × 8-9 μm. Ascospores oblong fusoid, 3 septate, second cell from above slightly swollen, yellowish green, 16-25 × 4.5-5 μm, smooth to finely punctate. Pycnidia found in host associated with green stains on grass or cereal stubble, sometimes associated with pseudothecia, also produced in culture from monoascosporic and monoconidial isolates up to 150 μm broad, ostiolate. Conidia cylindrical, pale brown, 1-3-5 septate, tapering towards the apex, 18-30 × 3-4 μm formed on pyriform, hyaline, simple conidiogenous cells.

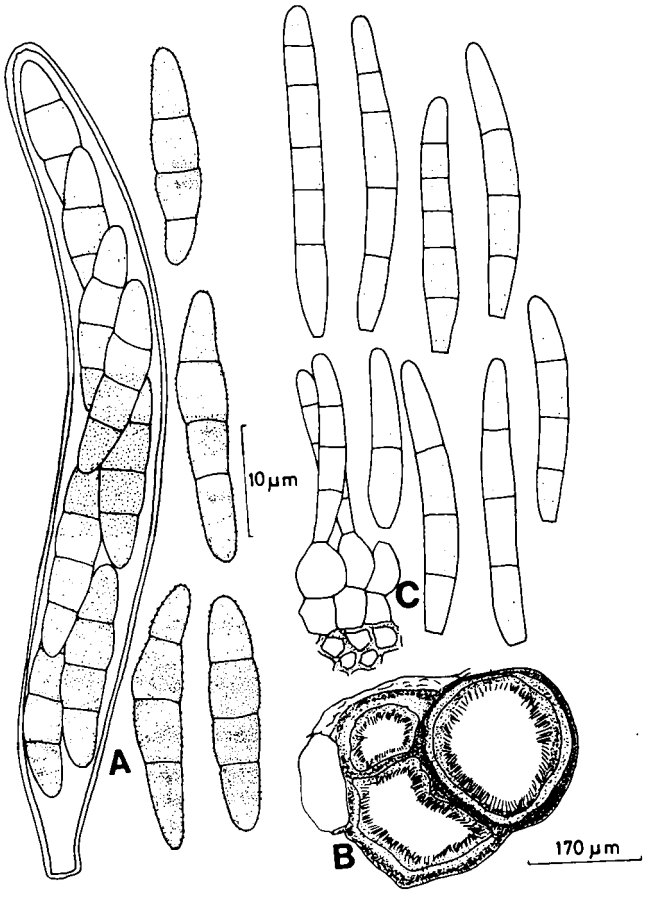


Fig. 283. *Leptosphaeria viridella.* A, ascus and ascospores; B, v.s. pycnidia; C, conidiogenous cells and conidia.

On graminicolous hosts especially *Dactylis glomerata, Juncus effusus* and *Triticum.* Europe, U.S.A.

Leptosphaeria species with Phaeoseptoria anamorph

Phaeoseptoria Speg.: Pycnidia at first immersed, later erumpent becoming superficial, with a wall composed of thin-walled, pale brown cells of textura angularis, ostiolate. Conidiogenous cells hyaline, holoblastic, undifferentiated. Conidia cylindrical, filiform, multiseptate, pale brown, smooth, with the base often truncate.

Key to Leptosphaeria species with Phaeoseptoria anamorph

Conidia 3-15 septate, 30-95 × 4-5.5 μm, ascospores 3 septate 22-28 × 7-8.5 μm. ..... *L. microscopica*

Conidia 6-13 septate, 50-112 × 2.5-5 μm, ascospores 5 septate, 28-36 × 5.5-6.5 μm..... *L. luctuosa*

Conidia 7-16 septate, 50-110 × 3-5 μm, ascospores 5 septate, 17-24 × 3-6 μm... ..... *L. nigrans*

Conidia 7-15 septate, 30-94 × 4-6 μm, ascospores 5-6 septate, 21-35 × 4.5-6.5 μm..... *L. fuckelii*

L. fuckelii Niessl in Voss., *Oesterr. Bot. Z.* **32:** 357, 1882 (Fig. 284).

Phaeosphaeria fuckelii (Niessl) L. Holm, *Symb. Bot. Upsal.* **14:** 123, 1957.

Anamorph: *Phaeoseptoria phalaridis* Sprague, *Mycologia* **35:** 485, 1943 (as *P. phalaridis* (Trail) Sprague)

Pseudothecia in rows, up to 200 μm broad. Asci 80-130 × 9-10 μm. Ascospores yellow, 5 septate (rarely 6 septate), 21-35 × 4.5-6.5 μm, fourth cell from above swollen, upper half of the spore tapered, composed of two cells longer than the rest.

Pycnidia in host as well as obtained in culture from monoascosporic and monoconidial isolates (Webster & Hudson, 1957) up to 200 μm broad. Conidia pale brown to brown, 7-15 septate, cylindrical to narrowly obclavate, truncate at the base, tapering slightly to an obtuse apex, 30-94 × 4-6 μm.

On various graminicolous hosts. Europe, U.S.A.

L. luctuosa Niessl in Sacc., *Nuovo G. bot. Ital.* **7:** 321, 1875 (Fig. 285).

Anamorph: *Phaeoseptoria* sp. (Webster & Hudson, 1957).

Pseudothecia associated with reddish brown colouration of the host tissues on nodes and leaf sheaths, up to 200 μm broad. Asci 100-120 × 12-14 μm. Ascospores fusoid, 5 septate, slightly yellow brown, 28-36 × 5.5-6.5 μm.

Pycnidia and pseudothecia on host as well as derived in culture from monoascosporic and monoconidial isolates. Pycnidia up to 350 μm broad. Conidia cylindrical to filiform, 6-13 septate, hyaline to pale brown, wider below, tapering above, 50-112 × 2.5-5 μm.

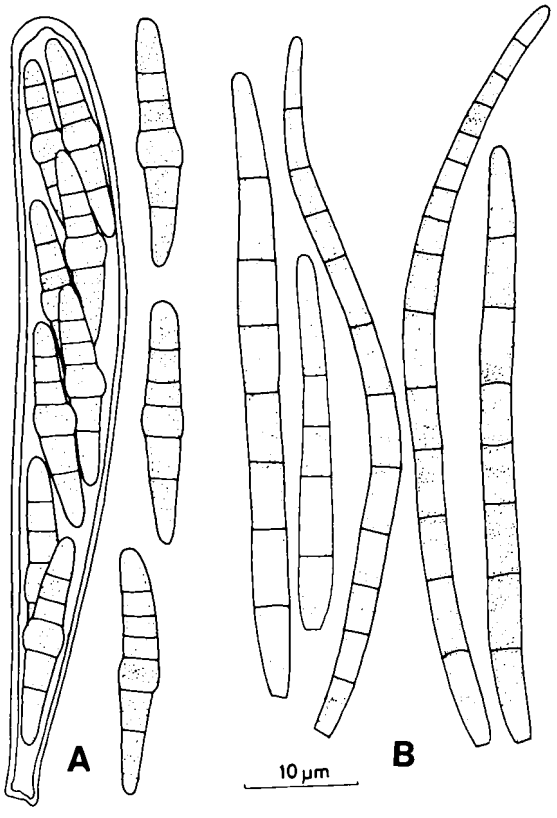


Fig. 284. *Leptosphaeria fuckelii.* A, ascus and ascospores; B, conidia.

On stems of various grasses, frequent in spring and early summer. Europe.

L. microscopica P. Karsten, *Öfvers. K. Vet. Akad. Förh.* **2:** 102, 1872 (Fig. 286).

L. culmorum Auersw. ex Rehm, *Ber. Natur hist. Ver. Augsberg.* **26:** 60, 1881. *Phaeosphaeria microscopica* (P. Karsten) O. Erikss., *Ark. Bot.* **6:** 426, 1967. *Phaeosphaeria microscopica* (P. Karsten) O. Erikss. var. *culmorum* O. Erikss., *Arkiv. Bot.* **6:** 427, 1967.

Anamorph: *Phaeoseptoria airae* (Grove) Sprague, *Mycologia* **35:** 485, 1943.

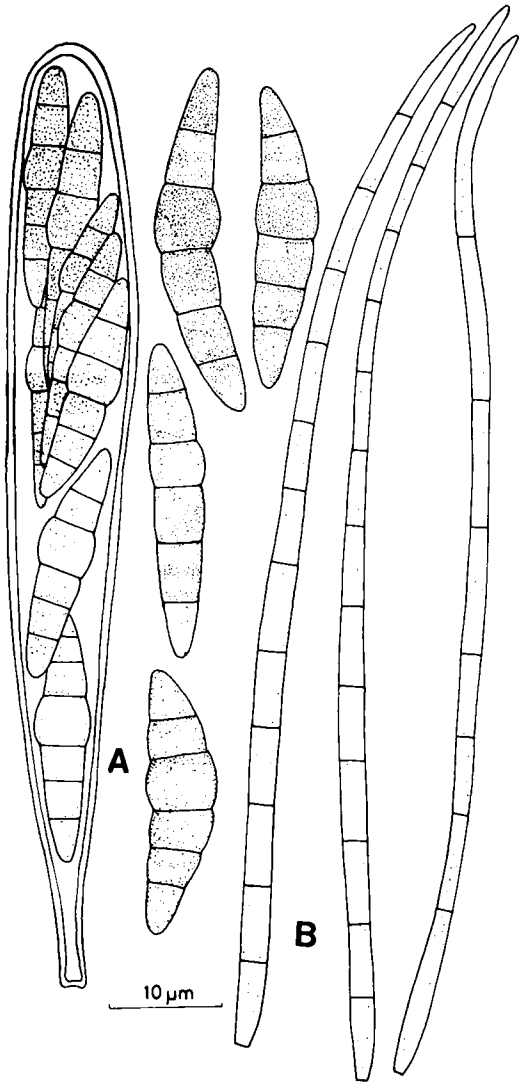


Fig. 285. *Leptosphaeria luctuosa.* A, ascus and ascospores; B, conidia.

Septoria alopecuri Sydow var. *airae* Grove., *Brit. Stem & Leaf Fungi* **1:** 425, 1935.
Phaeoseptoria festucae Sprague, *Mycologia* **35:** 487, 1943.

Pseudothecia in rows up to 200 µm broad. Asci 60-110 × 15-18 µm. Ascospores broadly fusoid, 3 septate, second cell from above often

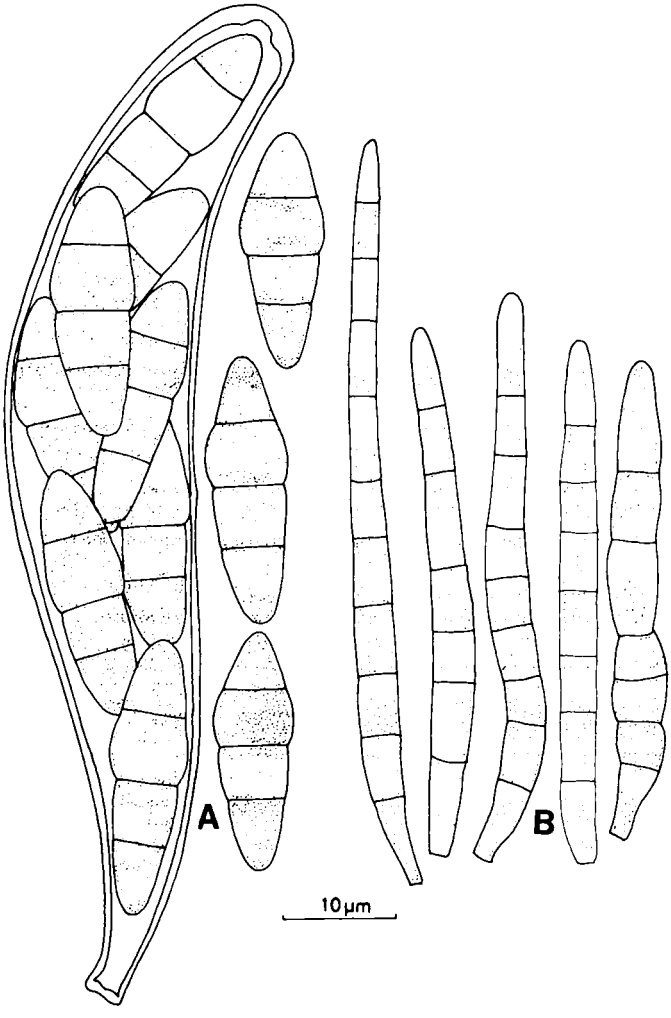


Fig. 286. *Leptosphaeria microscopica*. A, ascus and ascospores; B, conidia.

swollen, pale yellow brown to honey yellow brown, smooth to finely punctate (in oil immersion), inequilateral, constricted at the septa more so at the middle, 22-28 × 7-8.5 µm.

Pycnidia in host immersed up to 210 µm broad. Conidia cylindrical, yellow brown, 3-15 septate, often constricted at the septa, guttulate somewhat tapering towards the apex, 30-95 × 4-5.5 µm formed singly on obpyriform, hyaline, holoblastic, simple conidiogenous cells lining the inside cavity of the pycnidium.

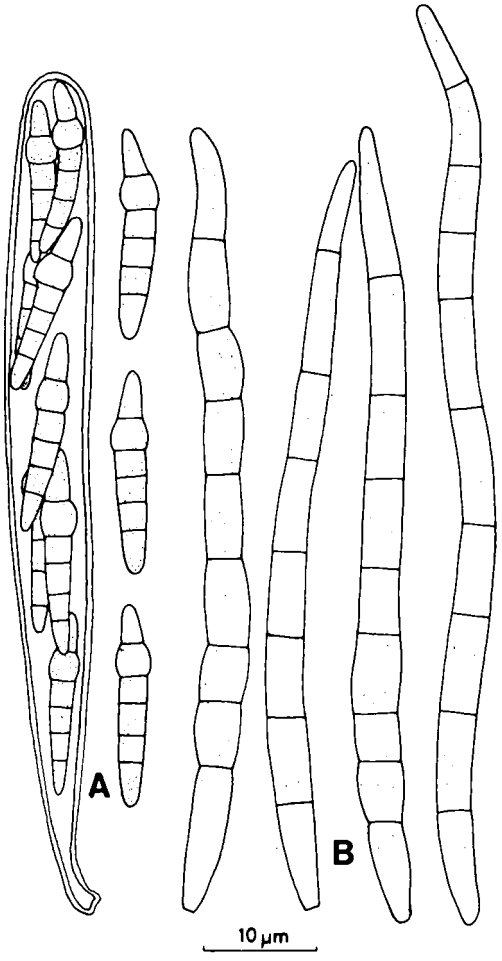


Fig. 287. *Leptosphaeria nigrans.* A, ascus and ascospores; B, conidia.

Webster (1955a) has produced the pseudothecia and pycnidia in culture from ascospore isolates.

On a wide variety of graminicolous hosts.

L. nigrans. (Rob. ex Desm.) Ces. & de Not., *Comm. Soc. Critt. Ital.* **1:** 235, 1863 (Fig. 287).

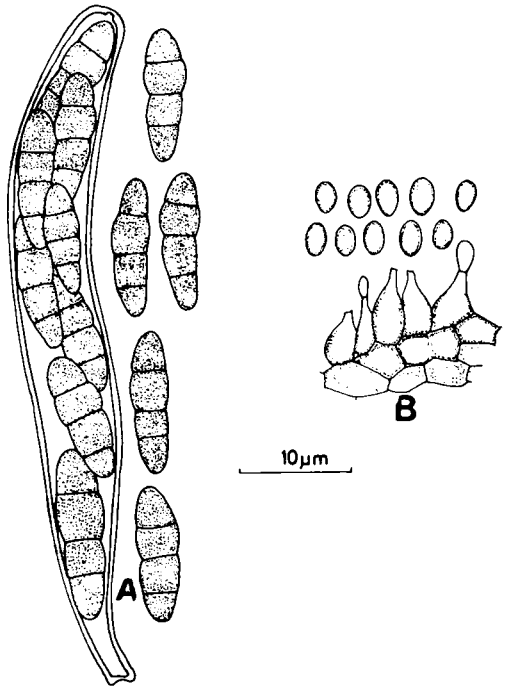


Fig. 288. *Leptosphaeria coniothyrium.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Sphaeria nigrans Rob. ex Desm., *Ann. Sci. nat Bot. ser.* **6:** 79, 1846.
Leptosphaeria eustomella Sacc., *Michelia* **2:** 251, 1881.
Leptosphaeria lineolaris Niessl ex Link., *Fung. Hung.* no. 466, 1885.

Anamorph: *Phaeoseptoria* sp. (Hughes, 1949).

Pseudothecia up to 300 µm broad. Asci 60-110 × 8-12 µm. Ascospores subcylindric, yellow brown, 5 septate, second cell from above distinctly swollen, end cells obtuse, 17-24 × 3-6 µm.

Pycnidia derived from monoascosporic isolates (Hughes, 1949), up to 300 µm broad. Conidia hyaline to pale brown, 7-16 septate, usually curved, 50-110 × 3-5 µm.

According to Hughes (1949) the anamorph resembles *Septoria alopecuri* Sydow var. *calamagrostidis Grove.*

Common on dead culms and leaves of many genera of grasses. Europe.

Leptosphaeria species with Coniothyrium anamorph

L. coniothyrium (Fuckel) Sacc., *Nuovo G. bot. Ital.* **7:** 317, 1875 (Fig. 288).

Sphaeria coniothyrium Fuckel, *Symb. mycol.:* 115, 1870.
Melanomma coniothyrium (Fuckel) L. Holm, *Symb. Bot. Upsal.* **14:** 56, 1957.

Anamorph: *Coniothyrium fuckelii* Sacc., *Nuovo G. bot. Ital.* **8:** 220, 1876.

Pseudothecia gregarious, immersed in the cortex up to 300 μm broad. Asci 65-70 × 5-6 μm. Ascospores ellipsoidal, 3 septate, pale olivaceous brown, 12-15 × 3.5-5 μm.

Pycnidia immersed in the cortex becoming erumpent, up to 260 μm broad, ostiolate. Conidiogenous cells enteroblastic, phialidic, ampulliform to globose, arising from the cell lining the inside of the pycnidial cavity. Conidia one celled, olivaceous to pale brown, short ellipsoidal, smooth, 2.5-5 × 1.5-2.5 μm.

Plurivorous causing diseases recognised as cane blight of blackberry and raspberry, spur blight of raspberry, common stem and leaf canker of roses, burn bark of roses, canker of apples, peach and Japanese apricot, also associated with root rot of strawberry.

Punithalingam (1980c) has fully described and illustrated this species with notes on disease symptoms.

Leptosphaeria species with Diplodina anamorph

L. marcyensis (Peck) Sacc., *Syll. Fung.* **2:** 80, 1883 (Fig. 289).

Sphaeria marcyensis Peck, *Rep. N.Y. St. Mus.* **31:** 51, 1879.

Anamorph: *Diplodina* sp. (Lucas & Webster, 1967).

Pseudothecia often on the margin of the leaves, scattered, up to 65 μm broad. Asci 65-70 × 12-14 μm. Ascospores fusoid ellipsoidal, 3 septate, second cell from above wider, pale yellow, ends obtuse, 18-26 × 6-7.5 μm.

Pycnidia produced from single ascospore isolates, up to 240 μm broad. Conidiophores hyaline, septate and branched, either doliiform or cylindrical and tapered from the cells lining the inside of the pycnidial wall. Conidiogenous cells enteroblastic, phialidic, hyaline, integrated,

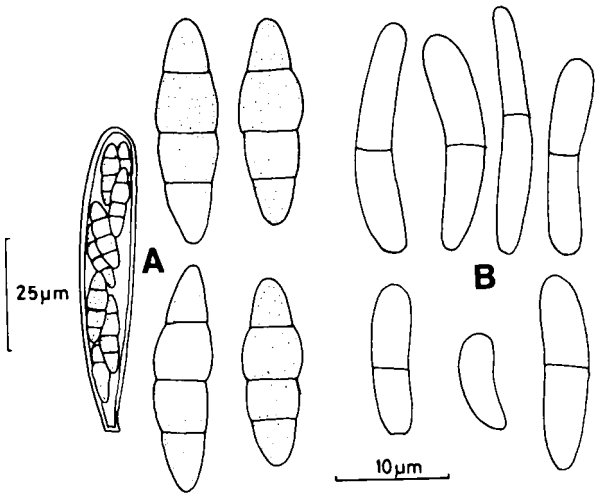


Fig. 289. *Leptosphaeria marcyensis.* A, ascus and ascospores; B, conidia.

determinate. Conidia cylindrical, often tapering towards the rounded apex, hyaline, one septate, 13-25 × 3-4 µm.

On *Lycopodium clavatum, L. annotinum.* Sweden, U.S.A.

Holm (1957) has commented on the similarity of this species to *L. lycopodina* (Mont.) Sacc.

MASSARINA Sacc., *Syll. Fung.* **2:** 153, 1883.

Massarinula Géneau de Lamarlière, *Rev. Gen. Bot.* **6:** 321, 1894.
Holstiella Henn. in Engler, *Pflanzenwelt Ost-Afrikas C:* 33, 1895.
Pseudodiaporthe Speg., *An. Mus. Nac. B. Aires* **19:** 35, 1909.
Oraniella Speg., *An. Mus. Nac. B. Aires* **19:** 378, 1909.
Phragmosperma Theiss. & H. Sydow, *Annls mycol.* **14:** 450, 1917.
Clypeothecium Petrak in H. Sydow & Petrak, *Annls mycol.* **20:** 182, 1922.
Parasphaeria H. Sydow, *Annls mycol.* **22:** 297, 1924.
Amphididymella Petrak, *Bot. Jahrb. Syst.* 62 *Beibl.* 142: 94, 1928.
Abaphospora Kirschst., *Annls mycol.* **37:** 96, 1939.
Trematostoma (Sacc.) Shear, *Mycologia* **34:** 272, 1942.
(After von Arx & E. Müller, 1975)

Type sp.: *M. eburnea* (Tul. & Tul.) Sacc., *Syll. Fung.* **2:** 153, 1883.

Anamorphs: Pycnidial states in *Coniothyrium* Corda, *Ceratophoma* Höhnel, *Diplodia* Fr., *Micosphaeropsis* Höhnel (Bose, 1961) and

Hyphomycetes states in *Anguillospora* Ingold, *Clavariopsis* de Wild and *Pyricularia* Sacc. (Ingold, 1942; Webster & Descals, 1979).

This is a very large genus composed of a heterogeneous assemblage of species. The genus is not homogeneous either on the basis of pseudothecial character, or in its anamorphs.

Pseudothecia gregarious, immersed in the bark, applanate to deeply depressed, ostiolate. The pseudothecial wall is thickened uniformly and of textura prismatica often covered over the apex by a small patch of black stromatic tissue forming a small clypeus with the outer layer of bark, composed of hyaline cells that are almost absent towards the base and towards the outside the cells are more thick-walled and olive brown. Clypeus made up of various texture from hyphal to textura prismatica. Asci cylindric-clavate, cylindrical, subsessile or short stalked, 8 spored, thickened at the apex. Ascospores hyaline, sometimes becoming yellow to brown at maturity, fusiform, elliptic-fusiform, straight or curved, 1-many transversely septate, with mucilaginous sheath, constricted at the septa, often guttulate; pseudoparaphyses filiform, septate, hyaline, branched.

Key to Massarina species with anamorphs

Ascospores 1 septate..... 1

Ascospores 1-3 septate..... 2

Ascospores 3-6 septate, 14-26 × 5-7 μm, anamorph *Diplodia*..... *M. papulosa*

1. Ascospores 18-28 × 4-9 μm, anamorph *Anguillospora*..... *Massarina* II

   Ascospores 20-24 × 4-5 μm, anamorph *Clavariopsis*..... *Massarina* I

   Ascospores 25-38 × 7-11 μm, anamorph *Coniothyrium*..... *M. corni*

2. Ascospores 14-25 × 4-7 μm, anamorph *Dendrophoma*..... *M. polymorpha*

   Ascospores 22-30 × 5-7 μm, anamorph *Pyricularia*..... *M. aquatica*

   Ascospores 21-28 × 4.5-8 μm, anamorph *Microsphaeropsis*... *M. brunaudi*

   Ascospores 27-32 × 5-9 μm, anamorph *Ceratophoma*..... *M. eburnea*

   Ascospores 25-35 × 9-11 μm anamorph *Ceratophoma*..... *M. cisti*

M. aquatica Webster, *Trans. Br. mycol. Soc.* **48:** 451, 1965 (Fig. 290).

Anamorph: *Pyricularia aquatica* Ingold, *Trans. Br. mycol. Soc.* **26:** 111, 1943.

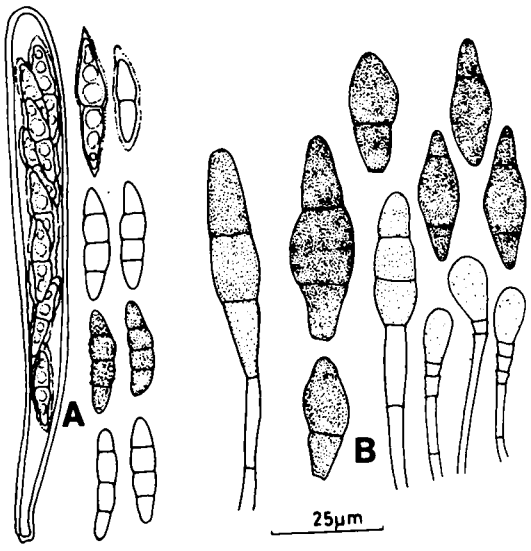


Fig. 290. *Massarina aquatica*. A, ascus and ascospores; B, conidiophores and conidia.

Pseudothecia superficial, solitary to aggregated, globose, black, ostiolate, up to 500 µm broad, non papillate. Asci numerous, 110-130 × 10-12.5 µm. Ascospores 1-3 septate with the second cell wider, ends acute, constricted at the mid-septum, hyaline, yellow to brown at maturity, surrounded by a mucilaginous sheath, 22-30 × 5-7 µm, smooth to rarely lightly verruculose.

Mycelium submerged, aquatic, branched, septate, hyaline to dark olivaceous. Submerged conidiophores, aquatic, 20-60 × 2-3 µm, profilerating percurrently. Conidia (aquatic) hyaline, lemon-shaped, usually 1 septate at the base, rarely 2 septate with the middle cell largest, 24-34 × 12-16 µm formed singly at the apex of the conidiophore, subsequent conidia produced in succession from near the same point of the first conidium locum.

Aerial conidia sparingly formed in culture. Aerial conidiophores 40-50 × 2-3 µm. Aerial conidia 24-42 × 8-12 µm, greenish brown, usually 2 septate.

Spermogonia of irregular sclerotioid conidiomata containing minute, hyaline, globose, one-celled spermatia less than 1 µm broad were reported in some cultures by Webster & Descals (1979).

On *Alnus glutinosa* and decaying leaves of *Quercus* spp. from a stream. Great Britain.

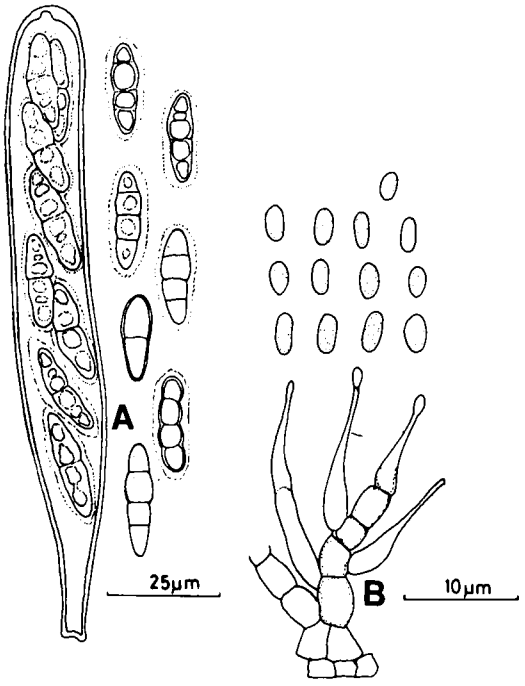


Fig. 291. *Massarina brunaudi.* A, ascus and ascospores; B, conidiophores and conidia.

M. brunaudi Bose, *Phytopath. Z.* **41:** 164, 1961 (Fig. 291).

Anamorph: *Microsphaeropsis* sp. (Bose, 1961).

Pseudothecia up to 250 µm broad with a papillate or elongated neck. Asci 60-92 × 14-16 µm. Ascospores oblong-fusoid, 3 septate, 21-28 × 4.5-8 µm.

Pycnidia formed in culture from single ascospore isolations, ovoid to pyriform, up to 500 µm broad, unilocular, ostiolate, with a wall composed of dark brown cells on the outside. Conidiophores septate, branched, hyaline, 15-30 × 2-4 µm formed from the cells lining the locule. Conidia pale brown, one celled, ovoid, 2.5-4 × 1.5-2 µm, formed singly at the apex of the conidiophore.

On decorticated twigs of *Spartium junceum.* France.

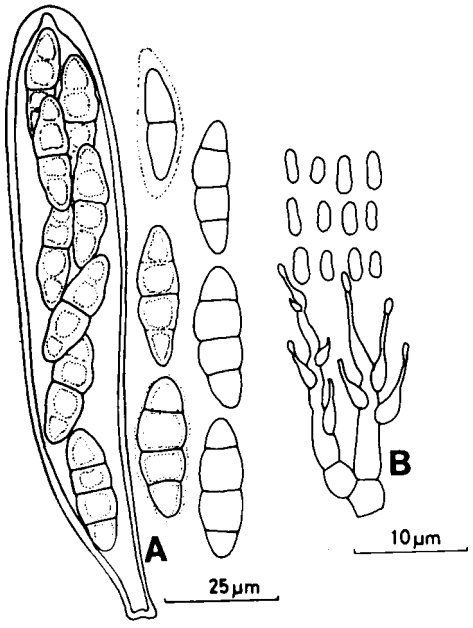


Fig. 292. *Massarina cisti* (type). A, ascus and ascospores; B, conidiophores and conidia.

M. cisti Bose, *Phytopath. Z.* **41:** 163, 1961 (Fig. 292).

Anamorph: *Ceratophoma* sp. (Bose, 1961).

Pseudothecia up to 425 µm broad. Asci 50-100 × 14-18.5 µm. Ascospores oblong fusoid, 3 septate, 25-35 × 9-11 µm.

Pycnidia formed in culture from single ascospore isolations, globose to pyriform, up to 500 µm broad, composed of dark brown cells. Conidiophores hyaline, elongated, simple, 12-25 × 2 µm. Conidia formed singly at the apex of the conidiophore, oblong to globose-ovoid, one celled, hyaline, 2-2.5 × 1 µm.

On decorticated twigs of *Cistus albidus;* France.

M. corni (Fuckel) Sacc., *Syll. Fung.* **2:** 154, 1883 (Fig. 293).

Massaria corni Fuckel, *Symb. mycol.* **1:** 303, 1871.

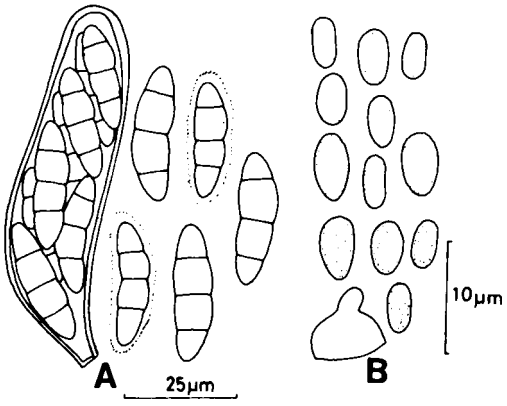


Fig. 293. *Massarina corni.* A, ascus and ascospores; B, conidiogenous cell and conidia.

Anamorph: *Coniothyrium* sp. (Bose, 1961).

Pseudothecia scattered, up to 150 μm broad. Asci 68-115 × 16-23 μm. Ascospores 1 septate, 25-38 × 7-11 μm.

Pycnidia formed in culture from single ascospore isolations, dark brown, ostiolate, up to 300 μm broad with a wall of dark brown cells. Conidiogenous cells hyaline, formed from the cells lining the cavity of the pycnidium. Conidia numerous, ovoid to oblong-elliptic, one celled, brown, 3.5-4.5 × 2-2.5 μm.

On *Cornus* and *Ostrya*. Europe.

M. eburnea (L.R.&C.Tul.) Sacc., *Syll. Fung.* **2:** 153, 1883 (Fig. 294).

Massaria eburnea L.R. & C. Tul., *Sel. Fung. Carp.* **2:** 239, 1863.
Sphaeria pupula var. *minor* Desm., *Pl. Crypt. du Nord France* No. 1764, 1851.
Cladosphaeria fuscidula Otth in *Trog, Mitt. Naturf. Cressells.* No. 658-662, 37-70, 1869.
Massaria eburnoides Sacc., *Michelia* **1:** 41, 187.
Massarina eburnoides (Sacc.) Sacc., *Syll. Fung.* **2:** 153, 1883.

Anamorph: *Ceratophoma* sp. (Bose, 1961).

Pseudothecia usually clustered, immersed, up to 700 μm broad, often clypeate. Asci 90-170 × 11-16 μm. Ascospores biseriate in the ascus, oblong-fusoid, 3 septate, 27-32 × 5-9 μm.

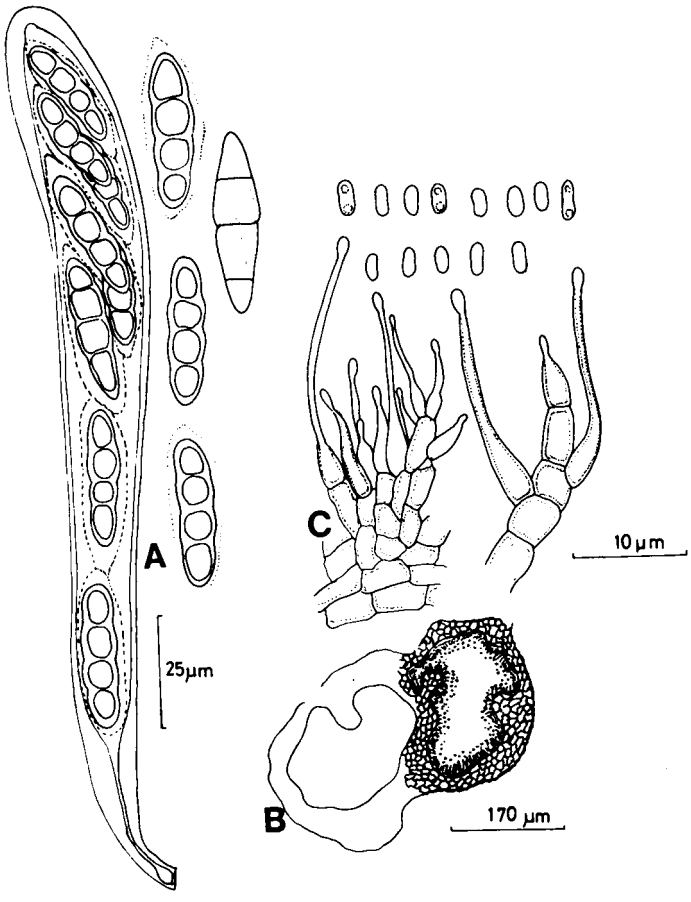


Fig. 294. *Massarina eburnea.* A, ascus and ascospores; B, v.s. pycnidium; C, conidiophores and conidia.

Pycnidia produced in culture from single ascospores are globose with a papillate to elongated neck, up to 400 µm broad, unilocular, ostiolate, composed of dark brown thick-walled cells. Conidiophores hyaline, simple, septate, cylindrical, 10-50 × 2-4 µm formed from the cells lining the locule. Conidia formed singly at the apex of the conidiophore, ovoid, hyaline, one celled, 2-3 × 1-1.5 µm.

On dead branches of *Betula, Corylus* and *Fagus.* Europe.

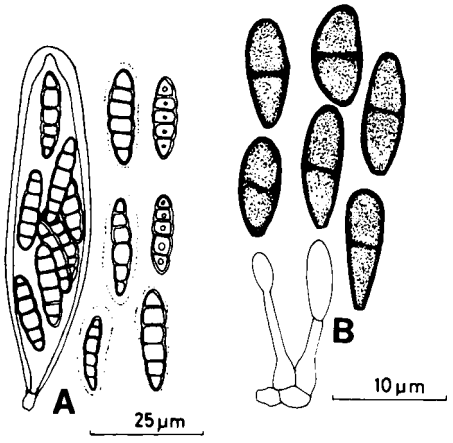


Fig. 295. *Massarina papulosa*. A, ascus and ascospores; B, conidiophores and conidia.

M. papulosa (Durieu & Mont.) Bose, *Phytopath. Z.* **41:** 176, 1961. (Fig. 295).

Sphaeria papulosa Durieu & Mont., *Flores d'Algerie* **1:** 536, 1846-1849.
For other synonyms refer to Bose (1961).

Anamorph: *Diplodia* Fr. (Bose, 1961).

Pseudothecia solitary or in stromatic groups, scattered, deeply immersed, sometimes in empty stroma of other Pyrenomycetes, up to 230 µm broad. Asci 50-85 × 14-22 µm. Ascospores 3-6 septate, 14-26 × 5-7 µm.

Pycnidia formed in culture from single ascospore isolations, globose to pyriform, ostiolate with a wall of dark brown cells. Conidiophores simple, rarely branched, 5-12 × 2-3 µm, formed from the cells lining the pycnidial cavity. Conidia hyaline at first becoming brown, septate in the middle, pyriform, clavate or elliptical, 7-16 × 2.5-5 µm.

On branches and leaves of *Ampelodesma, Araucaria, Arceuthobium, Athanasia, Chamaerops, Cirsium, Citrus, Cupressus, Dracaena, Eucalyptus, Euonymus, Hedera, Helichrysum, Jasminum, Linum, Lonicera, Menispermum, Mesembryanthemum, Mimulus, Phoenix, Pinus, Pteris, Robinia, Rhododendron, Rubus, Sarothamnus, Smilax, Ulmus,* Europe.

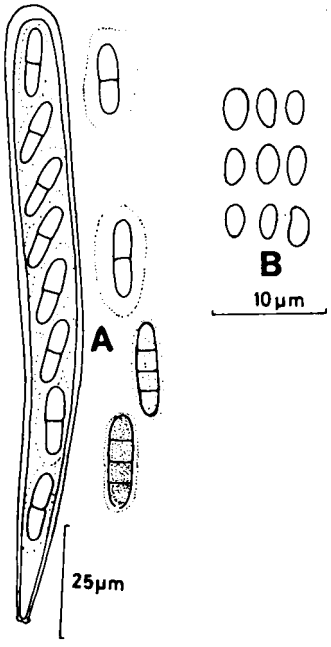


Fig. 296. *Massarina polymorpha*. A, ascus and ascospores; B, conidia.

M. polymorpha (Rehm) Sacc., *Syll. Fung.* **2:** 155, 1883 (Fig. 296).

Massaria polymorpha Rehm, *Hedwigia* **21:** 44, 1882.
Massarina himalayense E. Müller, *Sydowia* **11:** 461, (1957) 1958.

Anamorph: *Dendrophoma* sp. (Bose, 1961).

Pseudothecia up to 500 µm broad. Asci 60-110 × 9-14 µm. Ascospores 1-3 septate, 14-25 × 4-7 µm.

Pycnidia black, globose, ostiolate, up to 200 µm broad with a wall of brown cells, formed in culture from single ascospore isolations. Conidiophores hyaline, branched. Conidia hyaline, one celled, ovoid, 2-4 × 2 µm formed singly at the apex of the conidiophore.

On dead branches of *Rosa* spp. Europe.

Massarina sp. I. (Fig. 297).

Anamorph: *Clavariopsis aquatica* de Wild, *Annls Soc. belge Microsc.* **19:** 201, 1895.

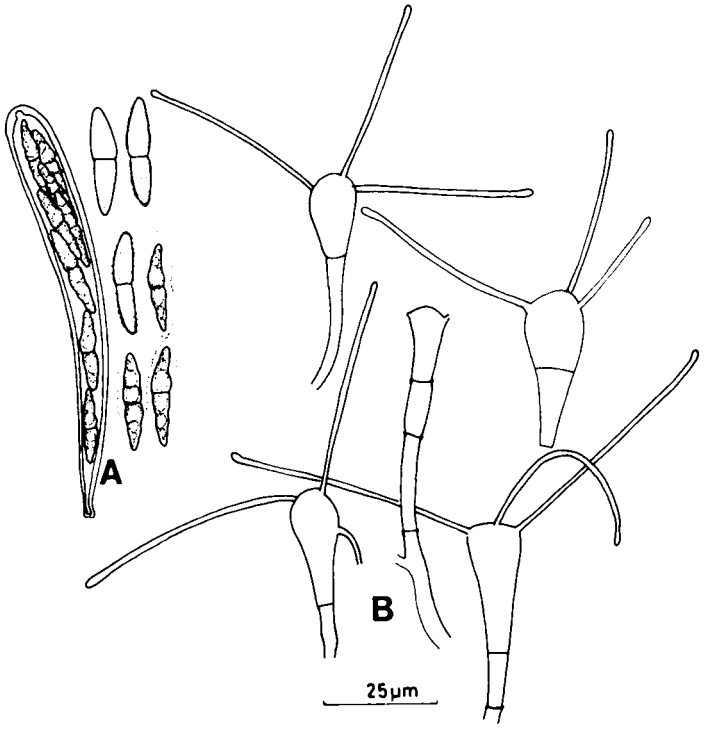


Fig. 297. *Massarina* sp. I. A, ascus and ascospores; B, conidiophore and conidia.

Pseudothecia superficial or semi-immersed in the wood, globose, mammiform or sub-conical, with a slightly raised rounded ostiole, black, slightly rough in appearance, up to 260 µm broad with a flattened base discolouring the area of wood around it. Asci cylindrical to cylindric-clavate, 62-82 × 11-12 µm, separated by filamentous pseudoparaphyses. Ascospores bi- to tri-seriate, canoe-shaped, hyaline, septate in the middle, 4-6 guttulate, constricted at the septum, straight or slightly curved, 20-24 × 4-5 µm, surrounded by a prominent mucilaginous sheath. Ascospores when mature become brown, smooth to echinulate.

Submerged aquatic fungus with branched, septate mycelium. Conidiophores usually simple, 50-250 µm long, 2-2.5 µm wide, apex proliferating percurrently. Conidia (aleuriospores) terminal, hyaline, consisting of a broadly clavate, two celled main part, 30-40 µm long, 3-4 µm broad at the base widening to 12-14 µm broad at the apex, with three long divergent processes 50-70 µm long, 1.5-2 µm broad developed from its truncate apex.

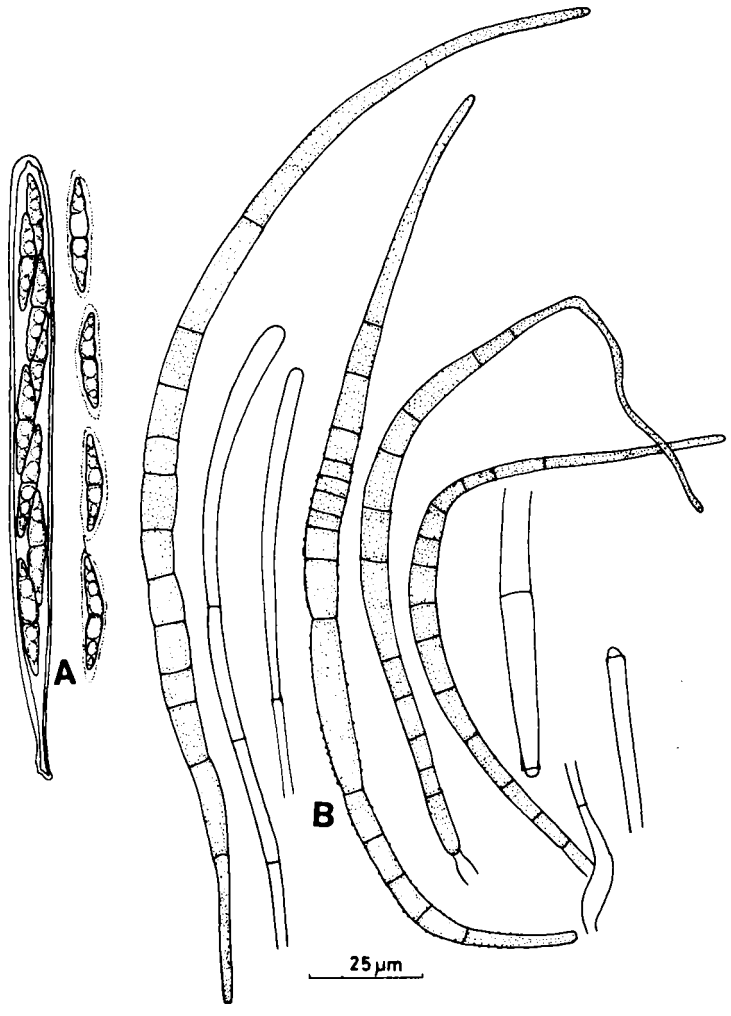


Fig. 298. *Massarina* sp. II. A, ascus and ascospores; B, conidiophores and conidia.

Spermogonia solitary, scattered to confluent, ostiolate. Conidia apparently budded off from the cells lining the pycnidial cavity, ovoid, hyaline, bi-guttulate, 3 × 1 µm.

Submerged aquatic fungus on decaying leaves of *Alnus* and *Salix*. Pseudothecia on decorticated twigs of *Fagus sylvaticus* submerged in a stream. Great Britain.

Massarina sp. II (Fig. 298).

Anamorph: *Anguillospora longissima* (Sacc. & Sydow) Ingold, *Trans. Br. mycol. Soc.* **25:** 402, 1942.

Fusarium longissimum Sacc. & Sydow, *Syll. Fung.* **14:** 1128, 1899.

Pseudothecia superficial on submerged decorticated wood, globose with flattened base, up to 240 μm broad with a non-papillate rounded ostiole. Asci cylindrical, 96-120 × 9-10 μm. Ascospores biseriate in the ascus, fusoid, septate in the middle, constricted at the septum, tapering towards the ends, 4-6 guttulate, 18-28 × 4-9 μm, with a mucilaginous sheath.

Submerged aquatic mycelium septate, branched, hyaline to greenish grey. Conidiophores usually simple, 50-150 μm long, 2-4 μm wide. Conidia terminal, 6-10 septate, curved or sigmoid, 200-350 μm long, 5-6 μm wide in the middle, smooth to verruculose, brown, separating when mature by the breakdown of separating cell at the end of the conidiophore (aleuric dehiscence). Sometimes the apex of the old conidiophore may develop percurrently inside the collar representing the remains of the separating cell and up to 3 successive collars have been formed.

Aquatic on submerged decaying leaves of *Alnus* and *Salix*. Pseudothecia developed on twigs of *Alnus, Fraxinus, Quercus* and *Salix* submerged in a stream for periods of 1-10 months, and subsequently incubated for 3-4 weeks under damp conditions in the laboratory (Webster & Descals, 1979). Great Britain.

MICROTHELIA Körber, *Syst. Lich. Germ.:* 372, 1855.

Type sp.: *M. biformis* (Leighton) Massee, *Misc. Lich.:* 28, 1856.

Several species included in this lichen genus need to be segregated into species of other genera like *Astrosphaeriella* H. & P. Sydow and *Kirschsteiniella* Petrak which have been included as synonyms by Müller & von Arx (1962). *M. incrustans* must be removed from the lichen genus *Microthelia* and placed perhaps in a new genus in the Pleosporales.

M. incrustans (Ell. & Ev.) Corlett & S. Hughes in S. Hughes, *N.Z. Jl. Bot.* **16:** 360, 1978 (Fig. 299).

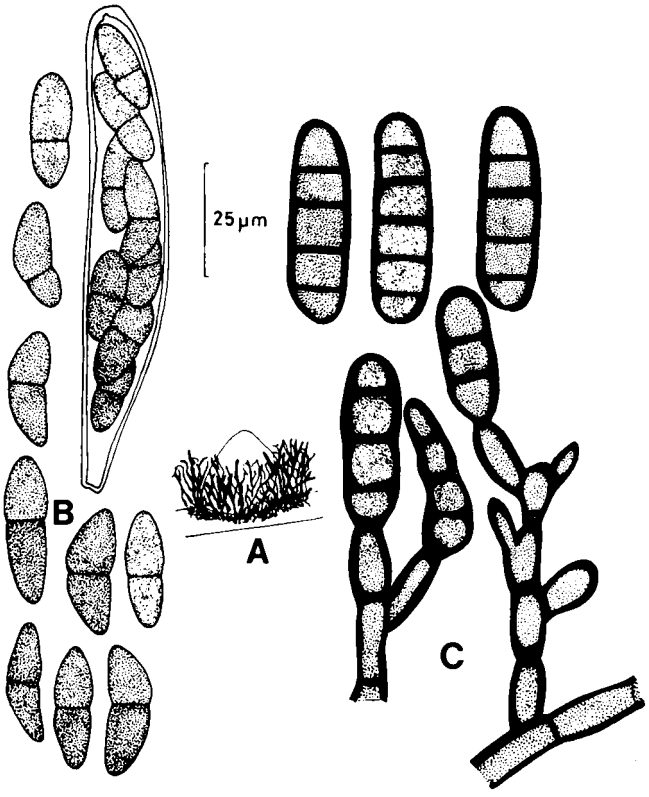


Fig. 299. *Microthelia incrustans* (type). A, pseudothecium with conidial colony; B, ascus and ascospores; C, conidiophores and conidia.

Amphisphaeria incrustans Ell. & Ev., *North Am. Pyren.*: 201, 1892.

Anamorph: *Dendryphiopsis atra* (Corda) S. Hughes, *Can. J. Bot.* **31:** 655, 1953.

Dendryphion atrum Corda, *Icon. Fung.* **4:** 33, 1840.
Helmisporium rectum Berk. & M.A. Curtis in Berk., Grevillea **3:** 103, 1875.
Helmisporium obtusissimum Berk. & M. A. Curtis in Berk., loc. cit. 1875.
Dendryphion ellisii Cooke in Cooke & Ell., *Grevillea* **7**: 7, 1878.
Brachysporium obtusissimum (Berk. & M.A. Curtis) Sacc., *Syll. Fung.* **4:** 426, 1886.
Dendryphion quadriseptatum Cooke, *Grevillea* **17:** 65, 1889.
Dendryphion crustaceum Ell. & Ev. in Webber, *Rept. Nebr. Bd. Agric.*, **1889:** 85, 1890.
Dendryphion pachysporum Ell. & Ev., *Proc. Acad. Nat. Sci. Philad.* **1891:** 92, 1891.

Brachycladium crustaceum (Ell. & Ev.) A.L. Smith, *J. Bot. Lond.* **41:** 259, 1903.
Brachycladium pachysporum (Ell. & Ev.) A.L. Smith, loc. cit. **41:** 259, 1903.

Pseudothecia gregarious to scattered, ovate-globose, up to 300 μm broad, with a papillate or obtusely conical ostiole and with the base immersed in the wood. The wall of textura carbonacea is composed of dark brown, thick-walled cells. Asci sessile, oblong cylindrical, 70-75 × 12-15 μm. Ascospores clavate-oblong, often slightly curved, 1 septate in the middle or unequally septate, constricted at the septum, brown, 22-27(37) × 7-8(12.5) μm. Pseudoparaphyses filiform, hyaline, septate, branched.

Conidial colonies associated with pseudothecia, effuse, black, hairy. Conidiophores branched at the apex forming a stipe and head. Stipes up to 500 μm long, 8-11 μm thick, branches 6-9 μm thick. Conidia pale to dark smoky brown or olivaceous brown, simple, acrogenous, polytretic, cylindrical, rounded at the ends, or obclavate, smooth, thick-walled, 2 or more septate, 40-80 × 12-25 μm.

On wood. Europe, Kenya, New Zealand, N. America.

OPHIOBOLUS Riess, *Hedwigia* **1:** 27, 1854.

Type sp.: *O. acuminatus* (Sow.: Fr.) Duby in Rabenh. *Herb. Mycol.* ed. 2: 57, 1855.

Müller (1952) and Holm (1948) adopted a relatively broad generic concept for *Ophiobolus*.

Holm (1957) restricted *Ophiobolus* to species in which the ascospores separate into two halves, transferred others with enlarged cells in the ascospore to *Nodulosphaeria,* and those with long spirally coiled ascospores to *Leptospora.*

Shoemaker (1976) has described some Canadian and extralimital *Ophiobolus* species.

Müller (1952) treated the genus in a wider concept and included species now separated in *Acanthophiobolus, Entodesmium, Leptosphaeria* and *Leptospora.*

Pseudothecia single or aggregated, immersed, erumpent or becoming superficial, subglobose to pyriform, dark brown to black, sometimes coloured, smooth or with mycelial hyphae below and setae on the beak, with a short to long beak, with or without pseudoperiphyses and sometimes with projecting terminal hyphae. The pseudothecial wall is

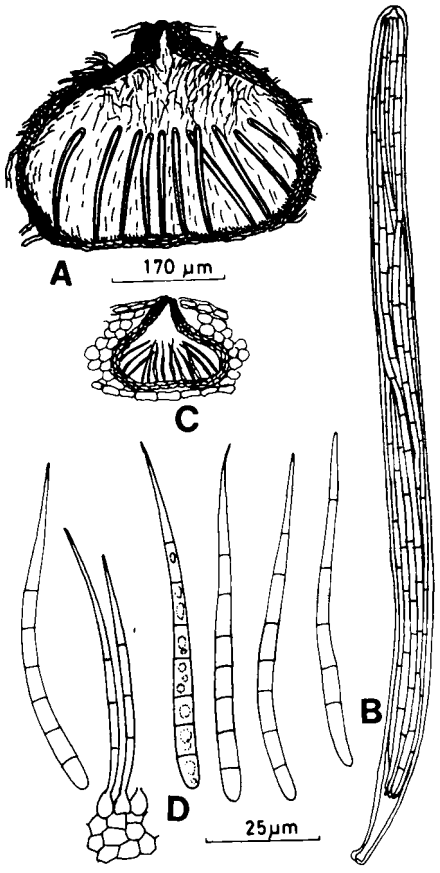


Fig. 300. *Ophiobolus herpotrichus*. A, v.s. pseudothecium; B, ascus; C, v.s. pycnidium; D, conidiogenous cells and conidia.

composed of a textura globosa on the outside and textura prismatica towards the inside. Asci numerous, long cylindric to clavate, stalked, 4-8 spored, arising from a basal hyaline tissue. Ascospores scolecosporous, multiseptate, often with one or more enlarged cells, rarely constricted at some of the septa, sometimes disarticulating into part spores or single cells, with or without a gelatinous mucilaginous terminal appendage. Pseudoparaphyses branched, hyaline, septate, narrow, persistent and mucilaginous, not conspicuous in mature pseudothecia.

O. herpotrichus (Fr.) Sacc. in Roum. & Sacc., *Rev. Mycol.* **3:** 45, 1881 (Fig. 300).

Sphaeria herpotricha Fr., *Syst. mycol.* **2:** 504, 1823.
Rhaphidospora herpotricha (Fr.) L.R. & C. Tul., *Sel. Fung. Carp.* **2:** 255, 1863.
Rhaphidospora herpotricha (Fr.) Ces. & de Not., *Comm. Soc. Critt. Ital.* **4:** 233, 1863.
Rhaphidospora herpotricha (Fr.) Fuckel, *Symb. mycol.:* 125, 1870.
Ophiobolus medusae Ell. & Ev. var. *minor* Ell. & Ev., *Proc. Acad. Nat. Sci. Philad.* **1890:** 239, 1890.
Ophiochaeta herpotricha (Fr.) Sacc. in Clem. & Shear, *The Genera of Fungi:* 277, 1931.
Ophiobolus zeae Saccas, *Rev. Path. Veg. Entom. Agr.* **30:** 183, 1951.
Phaeosphaeria herpotricha (Fr.) L. Holm, *Symb. Bot. Upsal.* **14:** 119, 1957.
Ophiosphaerella herpotricha (Fr.) J. Walker, *Mycotaxon* **11:** 74, 1980.

Anamorph: *Scolecosporiella* sp. (Webster & Hudson, 1957 as *Urohendersoniella* sp.).

Pseudothecia scattered or in rows, pyriform, with an erumpent short beak, upto 400 μm broad and 100 μm long lined with hyaline pseudoparenchyma. Asci numerous, subcylindric, 110-218 × 8-11 μm. Ascospores parallel to loosely coiled in the ascus, subcylindric, gradually tapering at the base, 8-20 septate, pale brown, 120-220 × 1.5-3 μm.

Pycnidia similar to pseudothecia with or without a neck. Conidia cylindrical, 3-7 septate, guttulate, 70-116 × 3-4 μm, truncate at the base with slender elongated apical cells.

Common on basal nodes of many grasses. Cosmopolitan.

OTTHIA Nits. ex Fuckel, *Symb. mycol.:* 170, 1870.

Type sp.: *O. spiraeae* (Fuckel) Fuckel, *Symb. mycol.:* 170, 1870.

O. spiraeae (Fuckel) Fuckel, *Symb. mycol.:* 170, 1870 (Fig. 301).

Cucurbitaria spiraeae Fuckel, *Fungi Rhenani Exs. no.* 975, 1863.
Otthia pruni Fuckel, *Symb. mycol.:* 169, 1870.
Otthia rosae Fuckel, *Symb. mycol.:* 169, 1870.
Otthia pyri Fuckel, *Symb. mycol.* **1:** 307, 1871.
Otthia corylina P. Karsten, *Mycol. Fenn.* **2:** 59, 1873.

Anamorph: *Diplodia sarmentorum* (Fr.) Fr., *Summa veg. Scand.:* 417, 1846.

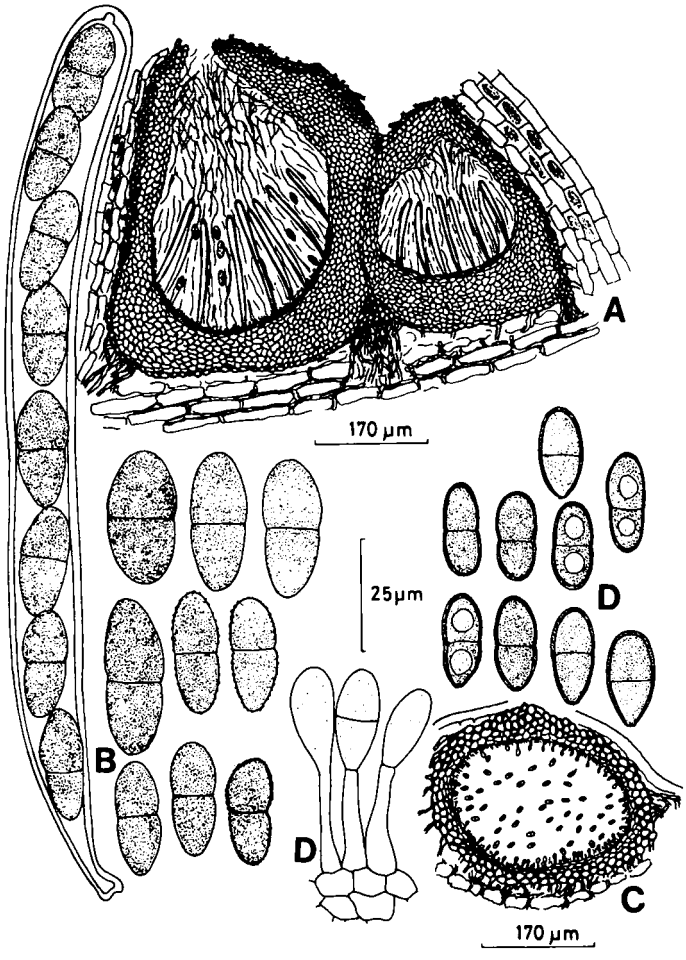


Fig. 301. *Otthia spiraeae* (type). A, v.s. pseudothecia; B, ascus and ascospores; C, v.s. pycnidium; D, conidiophores and conidia.

Sphaeria sarmentorum Fr., *Syst. mycol.* **2:** 498, 1823.
Sphaeria syringae Fr., *Syst. mycol.* **2:** 492, 1823.
Diplodia melaena Lév., *Ann.Sci. Nat.* **5:** 292, 1846.
Diplodia rosae Westend., Herb. *Crypt. Fasc.* no. 1227, 1859.
Diplodia pruni Fuckel, *Symb. mycol.:* 169, 1870.
Otthia syringae (Fr.) Niessl, *Hedwigia* **15:** 2, 1876.
Diplodia malorum Fuckel, *Symb. mycol.:* 395, 1879.
Otthia syringae (Fr.) Sacc., *Syll. Fung.* **1:** 737, 1882.

Pseudothecia in small clusters on a dark brown subiculum, subglobose to pyriform, with short stout necks, erumpent through cracks in the bark, stromatic. The pseudothecial wall up to 76 μm thick is composed of dark brown, thick-walled cells on the outer layers forming a textura angularis and elongated, thin-walled, hyaline pseudoparenchymatic cells in the inner layers. Asci cylindrical, short stalked, 4-8 spored, 160-220 × 17-26 μm arising from a basal cushion of hyaline thin-walled hymenial tissue. Ascospores overlapping uniseriate in the ascus, hyaline and one celled when young, becoming brown and 1 septate when mature, smooth to verruculose, slightly constricted at the septum, elliptical to slightly inequilateral, 24-32 × 10-15 μm. Pseudoparaphyses filiform, hyaline, branched.

Pycnidia solitary or sometimes in compound stromata, immersed to erumpent, up to 2 mm broad, unilocular, thick-walled ostiolate. The wall composed of an outer layer of dark brown thick-walled cells of textura angularis. Conidiophores hyaline, smooth, cylindrical, formed from the inner cells of the pycnidial wall. Conidiogenous cells holoblastic, cylindrical, hyaline, smooth, determinate, integrated or discrete, 10-15 × 4-5 μm, forming a single terminal conidium. Conidia at first hyaline, later brown, 1 septate, 17-24 × 7-10 μm, with an obtuse apex and a truncate base.

On dead twigs and branches of woody *Dicotyledons,* especially on *Acer, Citrus, Cladium, Crataegus, Fraxinus, Prunus, Pyrus, Salix* and *Ulmus;* Europe and U.S.A.

Booth (1958) obtained the pycnidial state from single ascospore isolations and has reviewed the history of the species. Stevens (1936) has also described the pycnidial state.

PARAPHAEOSPHAERIA O. Erikss., *Arkiv Bot.* **6:** 405, 1967.

Type sp.: *P. michotii* (Westend.) O. Erikss., *Arkiv Bot.* **6:** 405, 1967.

Anamorph: *Coniothyrium* Corda

Pseudothecia immersed, scattered, subglobose, ostiolate. The pseudothecial wall is composed of thin-walled, mid yellow brown cells forming a textura angularis, and the cells towards the outside are more pigmented. Asci numerous, clavate, 8 spored. Ascospores biseriate in the ascus, oblong to cylindrical, straight, 2-10 septate, dark brown, punctate, with broadly rounded ends, with or without a mucilaginous sheath. Pseudoparaphyses numerous, filiform, hyaline, branched.

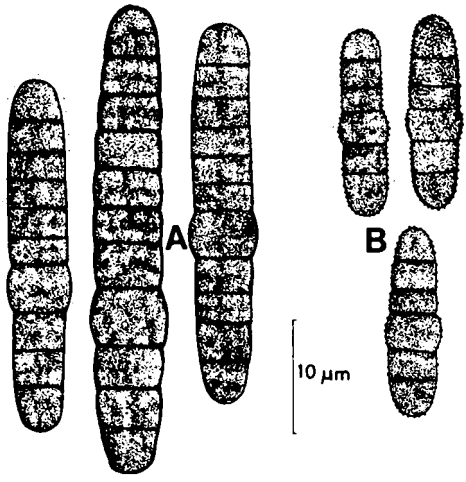


Fig. 302. A, *Paraphaeosphaeria castagnei* ascospores. B, *P. obtusispora* ascospores.

Only four species (Eriksson, 1967b) and they are all known to have a *Coniothyrium* anamorph. This genus is segregated from *Leptosphaeria* by the characters of the ascospore.

Key to Paraphaeosphaeria species with anamorphs

Ascospores 2 septate..... *P. michotii*

Ascospores 4 septate..... *P. rusci*

Ascospores 5 septate..... *P. obtusispora*

Ascospores 9-10 septate..... *P. castagnei*

P. castagnei (Dur. & Mont.) O. Eriks., *Arkiv Bot.* **6**: 406, 1967 (Fig. 302A).

Sphaeria castagnei Dur. & Mont. in Dur., *Fl. Algerie* **1**: 528, 1849.
Leptosphaeria castagnei (Dur. & Mont.) Sacc., *Fl. Ven.* **2**: 317, 1857.

Anamorph: ? *Coniothyrium castagnei* Sacc., *Syll. Fung.* **3**: 309, 1884 (Eriksson, 1967b).

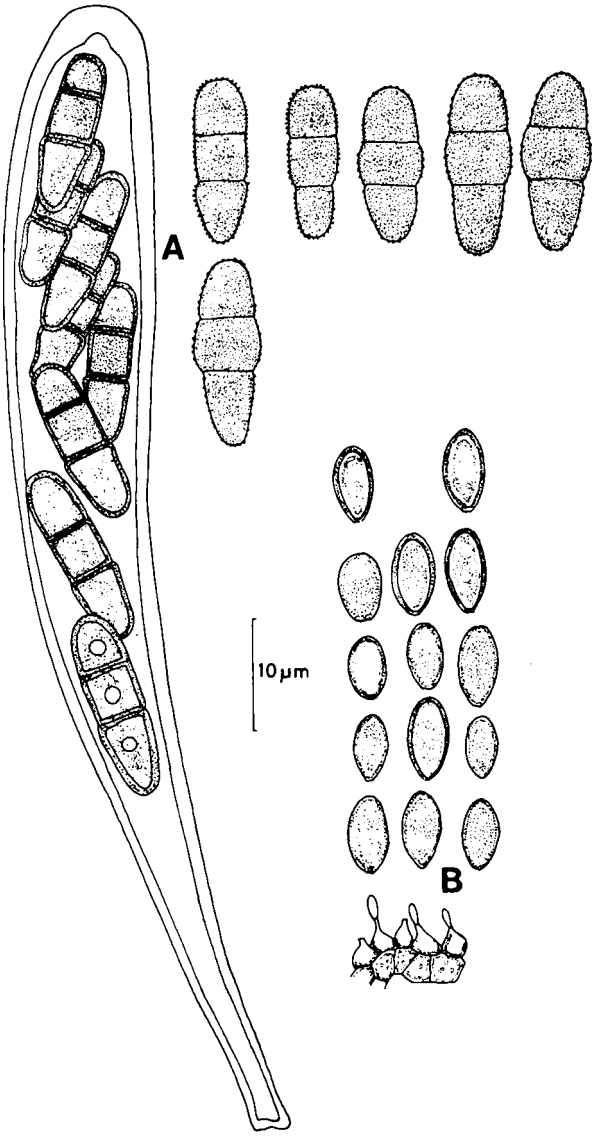


Fig. 303. *Paraphaeosphaeria michotii.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Pseudothecia up to 400 µm broad. Asci 120-150 × 12-15 µm. Ascospores 9-10 septate, 4th or 5th cell from below swollen, distal hemispore (1-) 2 (-3) septate, surrounded by a gelatinous sheath, 25-45 × 6-8 µm.

Conidia ovoid oblong, one celled, brown, 6-8 × 5-6 μm. Pycnidia only found on *Jasminum* is associated with pseudothecia but not obtained in culture.

On *Clematis montana, Euonymus europaeus, Hypericum, Jasminum fruticans, J. humile.* Algeria, India, Italy, W.Germany.

P. michotii (Westend.) O. Erikss., *Arkiv Bot.* **6:** 405, 1967 (Fig. 303).

Sphaeria michotii Westend., *Bull. Acad. Roy. Sci. Belg.* **7:** 87, 1859.
Sphaerella michotii (Westend.) Auersw. in Gonnerm. & Rabenh., *Mycol. Europ.* **5/6:** 18, 1869.
Sphaerella lamprocarpi Pass., *Erbario Crittogam Ital.:* 392, 1871.
Leptosphaeria trimera Sacc., *Nuovo G. bot. Ital.* **7:** 315, 1875.
Leptosphaeria michotii (Westend.) Sacc., *Fung. Ital.:* 279, 1878.
Leptosphaeria biseptata Auersw. fide Sacc., *Fung. Ital.:* 279, 1878.
Leptosphaeria lamprocarpi (Pass.) Sacc., *Syll. Fung.* **2:** 66, 1883.
Leptosphaeria folliculata Ell. & Ev., *Proc. Philad. Acad.* **1890:** 237, 1890.
Leptosphaeria iwamotoi Miyako, *J. Coll. Agr. Imp. Univ. Tokyo* **2:** 249, 1910.
Scleropleella michotii (Westend.) Höhnel, *Annls. mycol.* **18:** 76, 1920.
Didymosphaeria taiwanensis Yen & Chi, *J. Sugar Cane Res.* **8:** 94, 1954.

Anamorph: *Coniothyrium scirpi* Trail, *Scot. Nat. N.S.* 4, **10:** 65, 1889.

Pseudothecia up to 200 μm broad. Asci 55-100 × 12-15 μm. Ascospores biseriate, cylindrical, pale brown to brown, 2 septate, rarely 3 septate, constricted at the lower septum with the distal hemispore remaining non septate, punctate, 14-22 × 4-5 μm.

Pycnidia on host as well as formed in culture from monoascosporic isolates (Webster, 1955a), up to 200 μm broad, epiphyllous and immersed. Conidia hyaline to brown, ovoid to elliptical, one celled, 5-13.5 × 3-5 μm formed on phialidic, simple, one celled, obpyriform to clavate conidiogenous cell.

On *Saccharum officinarum* and a variety of other grasses. Causes leaf spot of sugar cane. Widespread. Shoemaker & Erkisson (1967) have described the teleomorph and Webster (1955a) has given the description of both the teleomorph and anamorph.

P. obtusispora (Speg.) O. Erikss., *Arkiv Bot.* **6:** 406, 1967 (Fig. 302B).

Leptosphaeria obtusispora Speg., *An. Soc. Cient. Arg.* **12:** 179, 1881.
Leptosphaeria translucens Winter, *Bol. Soc. broter.* **2:** 42, 1883.
Leptosphaeria aloes Dias & Camara, *Agron. Lusit.* **14:** 8, 1954.
Leptosphaeria draconis Urries, *Hungos microscopicos de Canarias:* 50, 1957.

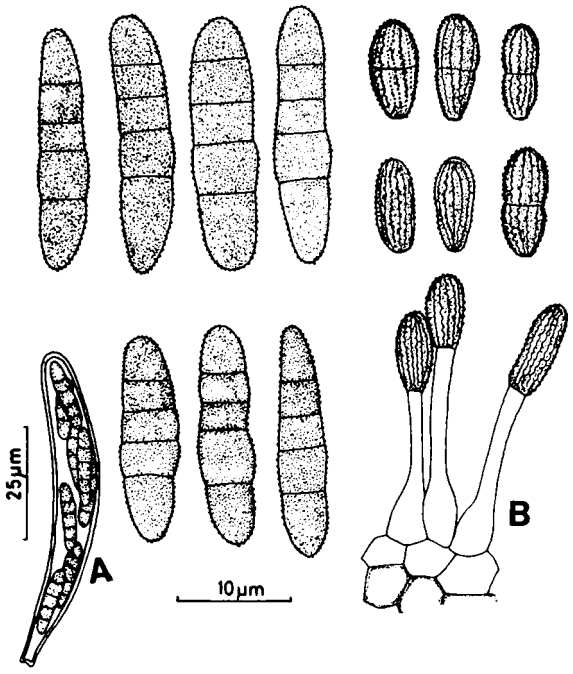


Fig. 304. *Paraphaeosphaeria rusci.* A, ascus and ascospores; B, conidiogenous cells and conidia.

Anamorph: *Coniothyrium henriquesii* Thüm., *Instituto, Coimbra* 27: 43 (reprint copy), 1879.

Microdiplodia henriquesii (Thüm.) Petrak & H. Sydow, *Annls. mycol.* **23:** 219, 1925.

Pseudothecia up to 250 µm broad, immersed, scattered, globose to pyriform. Asci 88-113 × 12-14 µm. Ascospores irregularly biseriate in the ascus, cylindrical, golden brown, thick-walled, finely punctate, 5 septate, 4 th cell from the apex swollen, distal hemispore 1 septate, 18-26 × 6-8 µm.

Pycnidia found associated with pseudothecia as well as produced in culture from monoascosporic and monoconidial isolations, more or less globose up to 500 µm broad, immersed to erumpent. Conidia oblong ovoid, brown, one celled, rarely 1 septate, 6-10 × 3-4 µm. In culture pycnidia were formed often with long necks. (Lucas, 1963).

On leaves of *Aloe, Agave, Dracaena, Fourcroya, Yucca.* Canary Islands, Portugal, U.S.A.

P. rusci (Wallr.) O. Erikss., *Arkiv Bot.* **6:** 406, 1967 (Fig. 304).

Sphaeria rusci Wallr., *Fl. Crypt. Germ.* **2:** 776, 1833.
Leptosphaeria rusci (Wallr.) Sacc., *Syll. Fung.* **2:** 74, 1883.

Anamorph: *Coniothyrium* sp.

Pseudothecia solitary or in groups, immersed, up to 180 μm broad. Asci 70-80 × 10-11 μm. Ascospores biseriate, cylindrical, 4 septate, 4th cell from the apex swollen, hemispore non septate, pale brown, 19-24 × 4-5 μm, punctate.

Pycnidia on host as well as formed in culture (Müller & Tomasevic, 1957), up to 250 μm broad, immersed. Conidia oblong or ellipsoidal, 0-1 septate, not or constricted at the septum, thick-walled, pale to dark brown, striately verruculose, 8-10 × 3.5-4 μm.

On *Ruscus aculeatus*. Europe.

Müller & Tomašević (1957) report that the *Coniothyrium* anamorph is similar to *C. hippoglossum* Mutto, *Haplosporella ruscigena* Bubak and probably to *Sphaeropsis rusci* Thüm. Bertini (1957) claimed *Diplodia rusci* Sacc. & Thüm. as the anamorph. According to Brefeld & Tavel (1891) it is *Phyllosticta ruscigena* Dur. & Mont.

PLEOMASSARIA Speg., *Anales Soc. Cienc. Argentina* **9:** 192, 1880.

Lectotype: *P. siparia* (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 239, 1883.

Anamorph: *Prosthemium* Kunze: Fr. and *Shearia* Petrak

Pseudothecia immersed in the bark without a stroma, flattened or globose to collapsed and saucer shaped, black, smooth, erumpent by a conical swelling or slit in the bark, composed of a thick wall, with often incomplete, angular, dark brown cells. Asci clavate to long cylindric-clavate, 6-8 spored, thick-walled, stalked. Ascospores distichous in the ascus, ellipsoid to fusoid-ellipsoid, golden brown, with many transverse septa and one or two vertical septa in the cells, constricted at the septa, surrounded by a mucilaginous sheath, smooth to finely punctate. Pseudoparaphyses filiform, hyaline, septate.

Prosthemium: Acervulus corticolous, subepidermal, rounded, dark brown, discrete, thick-walled. The upper wall composed of angular cells deshisces by irregular rupture of the overlying tissue. Conidiophores simple, septate, hyaline, filiform, confined to the basal region. Conidiogenous cells holoblastic, integrated, cylindrical, terminal, forming a single conidium at the apex. Conidia smooth, brown, consisting of

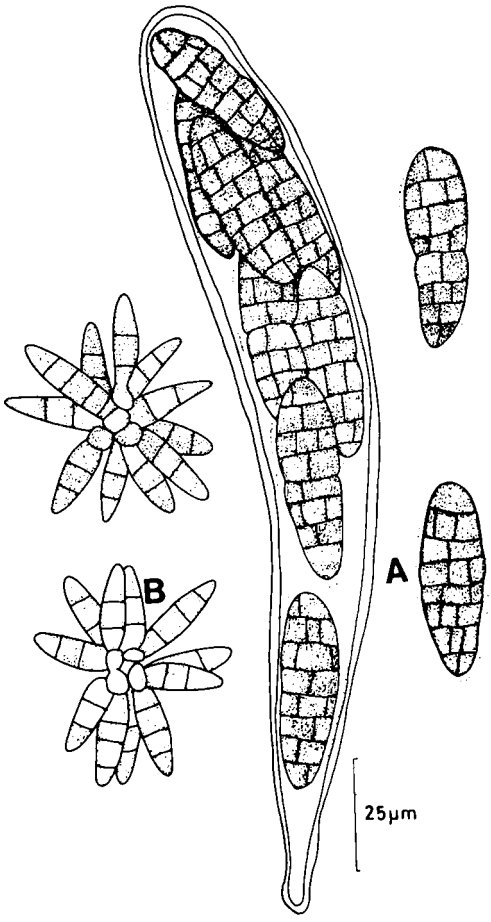


Fig. 305. *Pleomassaria holoschista*. A, ascus and ascospores; B, conidia.

many radiating transversely septate arms connected to a central cell. Mycelium immersed, branched, septate, pale brown.

Key to Pleomassaria species with Prosthemium anamorph

Ascospores 35-48 × 11-13 µm, conidia consisting of 10-14 radiating arms..... ..... *P. holoschista*

Ascospores 44-60 × 13-16 µm, conidia consisting of 3-5 radiating arms..... ..... *P. siparia*

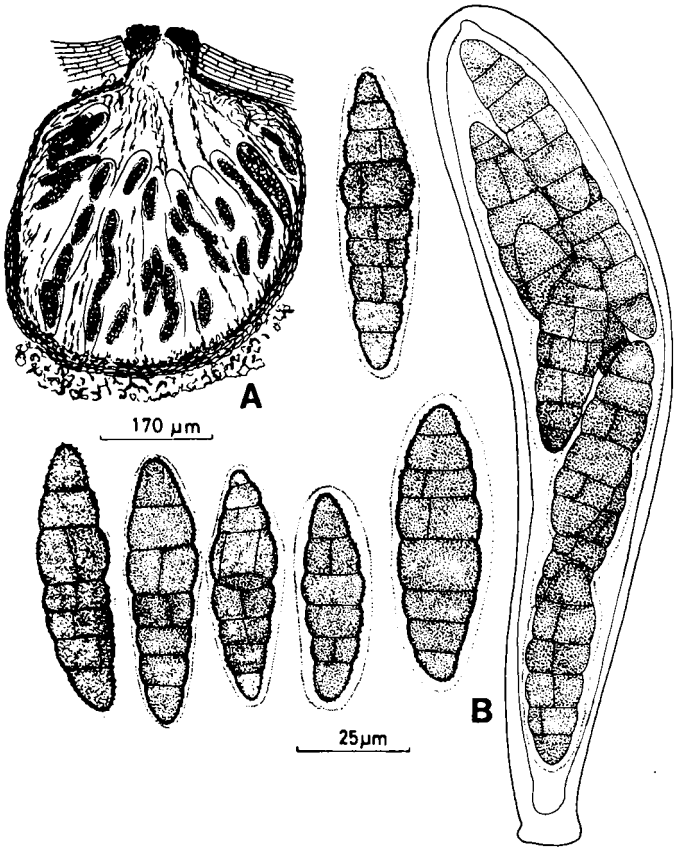


Fig. 306. *Pleomassaria siparia.* A, v.s. pseudothecium; B, ascus and ascospores.

P. holoschista (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 239, 1883 (Fig. 305).

Sphaeria holoschista Berk. & Br., *Ann. Mag. Nat. Hist. ser.* 3, **7:** 453, 1861.
Massaria holoschista (Berk. & Br.) L.R. & C. Tul., *Sel. Fung. Carp.* **2:** 233, 1863.

Anamorph: *Prosthemium stellare* Riess, *Bot. Ztg.* **11:** 130, 1853.

Pseudothecia in upper bark layers, globose, collapsed and saucer shaped, 350-500 µm wide. Asci broadly clavate, 6-8 spored, 180-200 × 28-34 µm. Ascospores, ellipsoid, 6-7 transversely septate and with several vertical septa, constricted at the septa and more strongly in the mid septum, 35-48 × 11-13 µm.

Acervulus up to 500 µm broad. Conidiophores up to 60 µm long ×

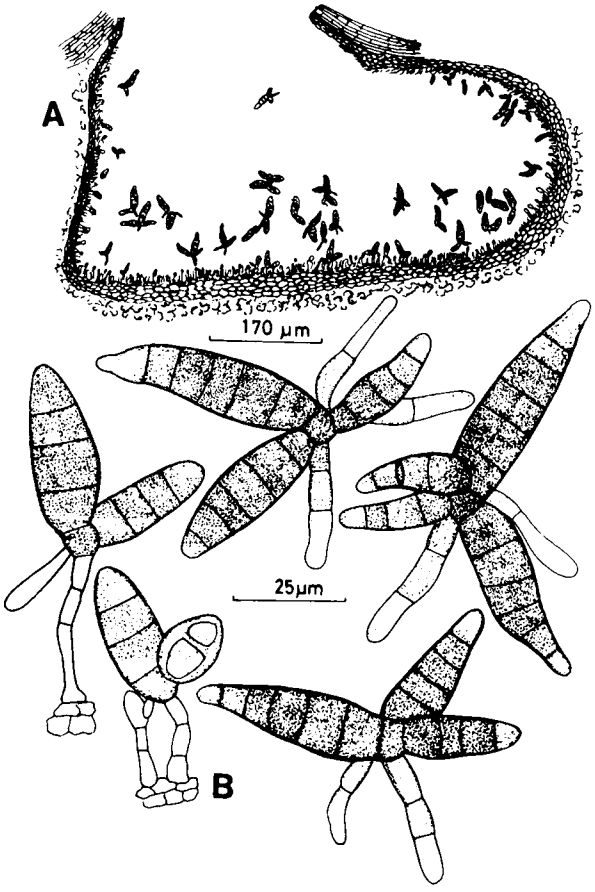


Fig. 307. *Pleomassaria siparia*. A, v.s. acervulus; B, conidiophores and conidia.

2.5-3 µm. Conidia consisting of 10-14 radiating arms, with each arm 2-3 septate connected to a central cell, and measuring 25-36 × 6-8 µm.

On *Alnus*. Great Britain.

P. siparia (Berk. & Br.) Sacc., *Syll. Fung.* **2:** 239, 1883 (Figs. 306, 307).

Sphaeria siparia Berk. & Br., *Ann. Mag. Nat. Hist. ser.* 2, **9:** 321, 1852.
Massaria siparia (Berk. & Br.) L.R. & C. Tul., *Sel. Fung. Carp.* **2:** 232, 1863.

Anamorph: *Prosthemium betulinum* Kunze in Schmidt & Kunze, *Mykol. Hefte* **1:** 18, 1817.

Pseudothecia immersed in the bark, flattened, erumpent by a minute slit in the bark, or by a small conical swelling, 600-1000 μm wide. Asci clavate to long cylindric-clavate, 8 spored, 200-250 × 40-45 μm. Ascospores fusoid elliptic, smooth to finely punctate, with 5-8 transversely septate and one to two vertical septa in some of the cells, constricted at the septa, 44-60 × 13-16 μm.

Conidia up to 140 μm diam., with 3-5 arms, each arm 5-septate and measuring 40-55 × 13-16 μm.

On dead branches of *Betula*. Canada, Europe, U.S.A.

Barr (1982) has reported *Shearia fusa* (Berk. & M.A. Curtis) Barr as the anamorph of *Pleomassaria maxima* Ell. & Ev. (= *P. magnoliae* Shear). The anamorph has been described and illustrated by Sutton (1980) in *S. formosa* (Ell. & Ev.) Petrak, a synonym of *S. fusa*.
P. acericola Petrak, *Sydowia* **6:** 10, 1952 is also associated with *Shearia acericola* Petrak (Barr, 1982).

PLEOSPORA Rabenh. ex Ces. & de Not., *Comm. Soc. Critt. Ital.* **1:** 217, 1863.

Cleistotheca Zukal, *Oesterr. Bot. Zeitschr.* **43:** 163, 1893.
Montagnula Berl., *Icon. Fung.* **2:** 68, 1896.
Graphyllium Clem., *Rep. Bot. Surv. Nebr.* **5:** 6, 1901.
Cleistothecopsis F. Stev. & True, *Bull. Ill. Expt. Sta.* **220:** 530, 1919.
Pseudopleospora Petrak, *Annls mycol.* **17:** 84, 1920.
Chaetoplea (Sacc.) Clem., *The genera of fungi:* 275, 1931.
(Synonyms after von Arx & Müller, 1975).

Type sp.: *P. herbarum* (Fr.) Rabenh. ex Ces. & de Not.

Anamorphs: *Alternaria* Nees: Fr., *Stemphylium* Wallr., *Phoma* Sacc., *Microdiplodia* Allesch., *Diplodia* Fr., *Camarosporium* Schulz., *Coniothyrium* Corda, *Hendersonia* Sacc. (*Stagonospora*).

Pleospora sensu Wehm. (1961) is a heterogeneous genus. Wehmeyer (1961) divided this genus into subgenera and sections based mainly on spore characters but several intermediates are encountered. Donk (1962) and Deighton (1965) have discussed the nomenclature of this genus.

Pseudothecia scattered, brown to black, unilocular, immersed, smooth or tomentose, with a protruding short papillate ostiole. The pseudothecial wall is composed of dark yellow brown cells forming a textura angularis, outer layer consists of thick-walled, dark brown cells and an inner thicker layer of thin walled, hyaline cells which become smaller and more compressed towards the innermost layer. Asci numerous, cylindric-clavate, short stalked, usually 8 spored, sometimes less. Asco-

spores irregularly biseriate in the ascus, ellipsoidal, straight, dictyoseptate, smooth or verruculose, sometimes with a mucilaginous sheath, yellow brown to dark brown. Pseudoparaphyses numerous, filiform, branched.

Mature pseudothecia can be produced by keeping conidial isolates on nutrient media at temperatures of 0-5°C for 2-6 months.

Key to Pleospora species with anamorphs

Ascospores always with 3 transverse septa..... 1

Ascospores with more than 3 transverse septa..... 2

1. Ascospores fusoid ellipsoid, with pointed ends, 15-21 × 7-8 μm..... *P. calvescens*

   Ascospores fusoid ellipsoid with pointed ends, 20-25 × 6-9 μm..... *P. papaveracea*

   Ascospores oblong with rounded ends, 13-15 × 4-6 μm..... *P. agavicola*

   Ascospores broadly ellipsoid with rounded ends or clavate, 18-25 × 7-10 μm..... *P. betae*

2. Ascospores usually with 5 transverse septa..... 3

   Ascospores usually with more than 5 transverse septa..... 7

3. Ascospores large, 35-65 × 14-25 μm..... *P. scirpicola*

   Ascospores less than 35 μm long..... 4

4. Ascospores less than 10 μm wide..... 5

   Ascospores more than 10 μm wide..... 6

5. Ascospores 22-28 × 7-9.5 μm..... *P. vagans*

   Ascospores 19-23 × 6-7 μm..... *P. vitalbe*

   Ascospores 15-22 × 6.5-9 μm (mostly 3 septate)..... *P. shepherdiae*

6. Ascospores 26-32 × 12-13 μm..... *P. vagans* var. *spartinae*

   Ascospores 14-28 × 6-12 μm..... *P. infectoria*

   Ascospores 20-25 × 10-12 μm..... *P. media*

7. Ascospores with 6-10, mostly 7, transverse septa..... *P. valesiaca*

   Ascospores always with 7 transverse septa when mature..... *Pleospora* sp. with *Stemphylium* states, *P. herbarum* and *P. triglochinicola*

Alternaria Nees: Fr.: Colonies effuse, grey, dark brown to black with

immersed or partly superficial, olivaceous brown to brown mycelium. Conidiophores simple or branched, solitary or in fascicles, pale to brown. Conidiogenous cells polytretic, sympodial, cicatrized, terminal becoming intercalary. Conidia dry, solitary or catenate, ovoid, obclavate, often rostrate, pale brown to dark or olivaceous brown, smooth to verrucose, with several transverse septa and frequently with oblique or vertical septa.

Stemphylium Wallr.: Colonies effuse, grey brown to black with immersed or partly superficial mycelium. Conidiophores simple or loosely branched, straight or flexuous, often nodose with a number of vesicular swellings, pale brown to brown, smooth or in part verruculose. Conidiogenous cells monoblastic, percurrent, integrated, terminal, at first clavate or subglobose with a thin wall at the apex, later often calyciform by invagination. Conidia dry, solitary, borne at the tip of the conidiophore, oblong, rounded at the ends, ellipsoidal, obclavate or subglobose, some species with a pointed conical apex and with lateral conical protrusions, pale to mid dark or olivaceous brown, smooth, verrucose or echinulate, dictyoseptate, often constricted at one or more of the septa, cicatrized at the base.

Key to Pleospora species with Alternaria anamorph

Ascospores 6-10 septate, 34-58 × 14-21 μm, conidia up to 13 transversely septate or distoseptate, 84-180 × 11-14 μm..... *P. valesiaca*

Ascospores 5 septate, 14-28 × 6-12 μm, conidia up to 8 transversely septate, 26-70 × 9-18 μm, mostly in chains and verrucose..... *P. infectoria*

Ascospores 4-5 septate, 35-65 × 14-25 μm, conidia up to 22 transversely septate or distoseptate, 40-300 × 12-16 μm..... *P. scirpicola*

Key to Pleospora species with Stemphylium anamorph

Conidia rounded at the apex..... 1

Conidia with pointed apex, 45-80 × 18-46 μm..... *P. triglochinicola*

1. Conidia mostly constricted at the median transverse septum..... 3

   Conidia frequently constricted at the three major transverse septa..... 4

3. Conidia 28-30 × 25-28 μm..... *Pleospora* state of *S. globuliferum*

   Conidia 26-42 × 24-30 μm..... *P. herbarum*

4. Conidia 20-50 × 15-26 μm..... *Pleospora* state of *S. vesicarium*

   Conidia 50-65 × 30-35 μm..... *Pleospora* state of *S. majusculum*

Key to Pleospora species with Stagonospora anamorph

Conidia 3 septate..... *P. vitalbe*

Conidia 3-7(14) septate..... 1

1. Conidia 3-7(14) septate, 24-46 μm long..... *P. vagans*

   Conidia 5-7 septate, 36-72 μm long..... *P. vagans* var. *spartinae*

Pleospora species with other conidial states

P. betae: Phoma anamorph
P. calvescens: Microdiplodia anamorph
P. media: Camarosporium anamorph
P. papavaracea: Dendryphion anamorph
P. shepherdiae: Coniothyrium anamorph
P. agavicola: Diplodia anamorph

P. agavicola nom. nov. (Fig. 308)

Cucurbitaria agaves H. & P. Sydow & E. Butler, *Annls mycol.* **9:** 406, 1911.

Anamorph: *Diplodia agaves* Niessl, *Hedwigia* **17:** 176, 1878.

Pseudothecia amphigenous, gregarious, erumpent, up to 250 μm broad. Asci 80-90 × 8-10 μm. Ascospores uniseriate in the ascus, oblong, 3 septate with one vertical septum in one or both central cells, 13-15 × 4-6 μm.

Diplodia conidia oblong rounded, septate in the middle, verruculose, 8-11.5 × 4.5-6 μm. According to Niessl, conidia measure 6-9 × 4 μm. The pycnidial state is closely associated with the pseudothecia and connected by a common separating wall.

On leaves of *Agave* spp. India.

There is already a *Pleospora agaves* de Not. described and therefore the epithet *agaves* cannot be used for *Pleospora agavicola*. *P. agaves* has 5-7 or more septate ascospores.

P. betae (Berl.) Nowodowski, *Gribỹ rossi exsiccati:* 247, 1915 (Fig. 309,A,B).

Pyrenophora echinella Cooke var. *betae* Berl., *Nuovo G. bot. Ital.* **20:** 208, 1888.

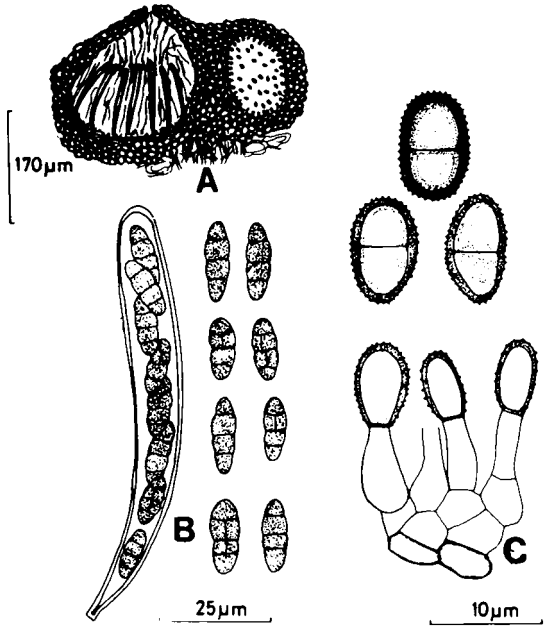


Fig. 308. *Pleospora agavicola.* A, v.s. pseudothecium and pycnidium; B, ascus and ascospores; C, conidiophores and conidia.

Pleospora betae Bjoerling, *Bot. Not.* **2:** 218, 1944.
Pleospora bjoerlingii Byford, *Trans. Br. mycol. Soc.* **46:** 614, 1963.

Anamorph: *Phoma betae* Frank, *Z. Ver. Rubenz. Indus. Dtsch. Reichs.* **42:** 904, 1892.

Phyllosticta betae Oudem., *Ned. Kruidk.Arch.ser.,* **2:** 181, 1876.
Phoma betae Bjoerling, *Bot. Not.* **2:** 215, 1944.

Pseudothecia immersed in the cortex, 260-400 µm broad. Asci 85-120 × 14-16 µm. Ascospores ellipsoidal to inequilaterally ovoid, 3 septate, with 1 vertical septum in the two central cells, constricted at the septum, 18-25 × 7-10 µm.

Pycnidia immersed in the cortex, globose, upto 250 µm broad. Phialides doliiform. Conidia hyaline, ellipsoidal, guttulate, 5-9 × 3-5 µm.

On *Beta* spp. Africa, Asia, Australasia, Europe, N. America.

Causes black leg of sugar beet and mangold. Also root rot, and leaf rot or heart rot, storage decay and damp roots.

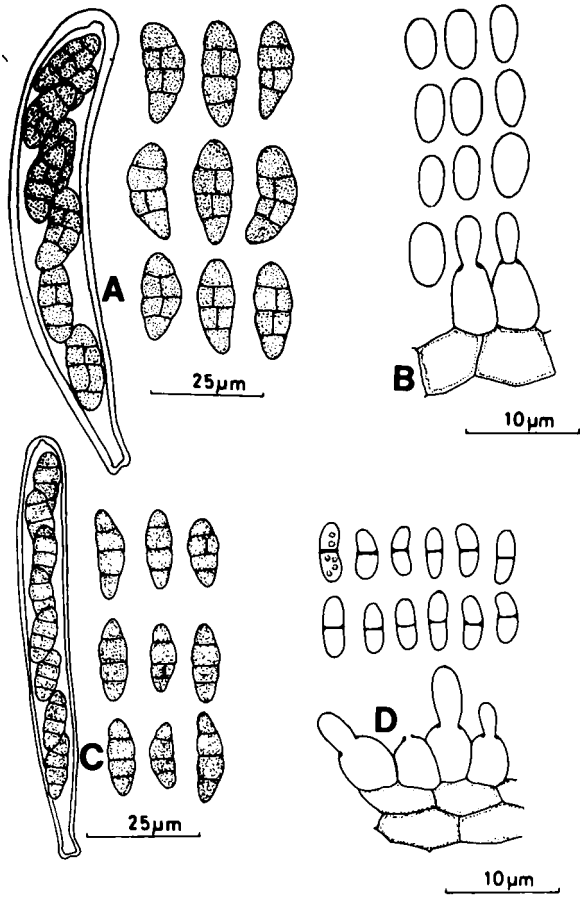


Fig. 309. *Pleospora betae*. A, ascus and ascospores; B, conidiophores and conidia. *P. calvescens*. C, ascus and ascospores; D, conidiophores and conidia.

P. calvescens (Fr. ex Desm.) L.R. & C. Tul., *Sel. Fung. Carp.* **2:** 266, 1863 (Fig. 309C,D).

Sphaeria calvescens Fr. ex Desm., *Ann. Sci. Nat. Bot.* ser. 2, **19:** 353, 1843.
Pyrenophora calvescens (Fr. ex Desm.) Sacc., *Syll. Fung.* **2:** 279, 1883.
Chaetoplea calvescens (Fr. ex Desm.) Clem., *The Genera of Fungi:* 275, 1931.

Anamorph: *Microdiplodia henningsii* Startz, *Hedwigia* **53:** 163, 1913.

Pseudothecia scattered in rows, up to 300 µm broad with stiff dark brown hairs. Asci 80-130 × 10-11 µm. Ascospores fusoid ellipsoidal, in-

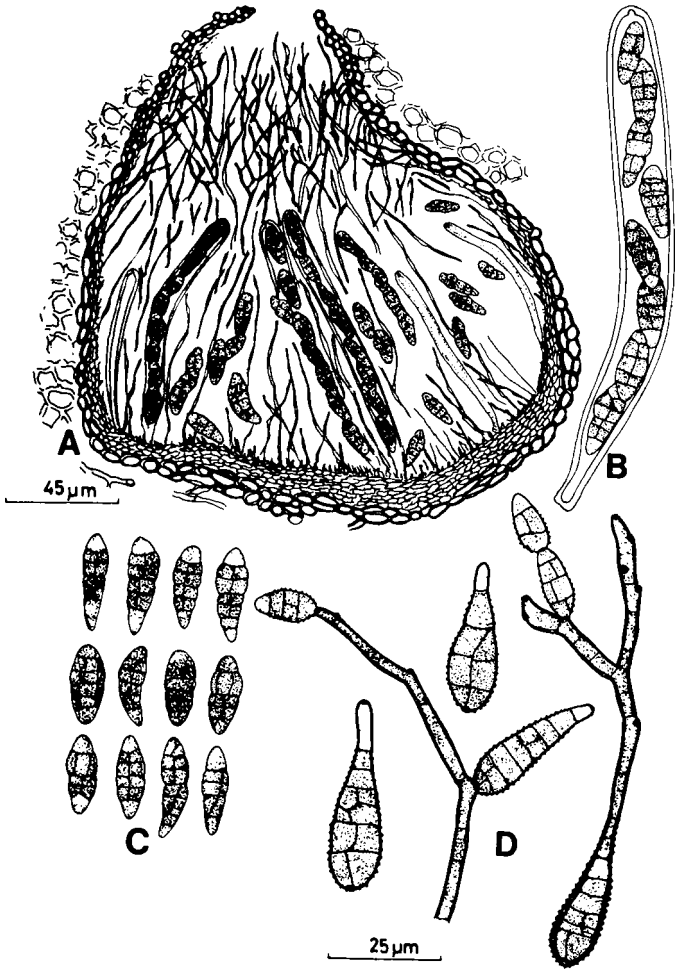


Fig. 310. *Pleospora infectoria.* A, v.s. pseudothecium; B, ascus; C, ascospores; D, conidiophores and conidia.

equilateral, 3 septate with a vertical septum in one or both the central cells, constricted at the septa, more so in the middle, yellow to pale brown, 15-21 × 7-8 µm.

Pycnidia immersed, with stiff hairs. Conidiogenous cells obpyriform to doliiform, simple, hyaline, enteroblastic. Conidia oblong cylindrical, straight or slightly curved, 1 septate, not or slightly constricted, somewhat thickened at the septum, subhyaline to pale brown, 6-13 × 4-7 µm with rounded ends.

On herbaceous dicotyledonous stems. Europe, U.S.A.

P. infectoria Fuckel, *Symb. mycol.*: 132, 1870 (Fig. 310).

Pyrenophora alternaria Whitehead & Dickson, *Mycologia* **44:** 748, 1952.

Anamorph: *Alternaria* sp.

Pseudothecia smooth or with a basal tomentosum, up to 300 μm wide, scattered or aggregated. Asci 75-120 × 10-25 μm. Ascospores oblong, ellipsoidal to fusoid, mostly 5 septate, with rarely one vertical septum in the end cells and with vertical walls in the central cells, pale to dark brown, straight or curved, with or without constrictions, symmetric or with the lower part longer and more tapered, 14-28 × 6-12 μm with broadly rounded to tapered ends.

Alternaria conidia in long chains, conical, obpyriform or obclavate, tapering gradually to a beak, often swollen at the tip, distinctly verruculose, pale to mid brown, with up to 8 transverse septa and several vertical septa, 26-70 × 9-18 μm.

On a wide range of dicotyledons. Europe, U.S.A.

P. herbarum (Fr.) Rabenh. ex Ces. & de Not., *Comm.Soc.Critt.Ital.* **1:** 217, 1863 (Fig. 311).

Sphaeria herbarum Fr., *Syst. mycol.* **2:** 511, 1823.
Sphaeria herbarum Fr., *K(svenska) Vetensk. Akad. (nya) Handl.* **39:** 109, 1818.

Anamorph: *Stemphylium botryosum* Wallr., *Fl. crypt. Germ.* **2:** 300, 1833.

Pseudothecia somewhat flattened, up to 600 μm broad, smooth or slightly tomentose. Asci 6-8 spored, 90-250 × 20-45 μm. Ascospores oblong, ellipsoidal to fusoid ellipsoidal or somewhat clavate, transversely 7 septate, with one complete series of longitudinal septa plus an incomplete series across one or more of the central cells, symmetric or more often asymmetric with the lower end longer and more tapered than the upper broader end, constricted at one or more of the septa with a broadly rounded apex and a characteristically flat base, 26-45 × 14-20 μm, yellow brown to mid dark brown.

Conidiophores up to 80 μm long, 4-7 μm thick. The terminal swollen cells are dark, each with a broad dark verrucose band a little below the apex and distinctly echinulate around it. Conidia varying in shape,

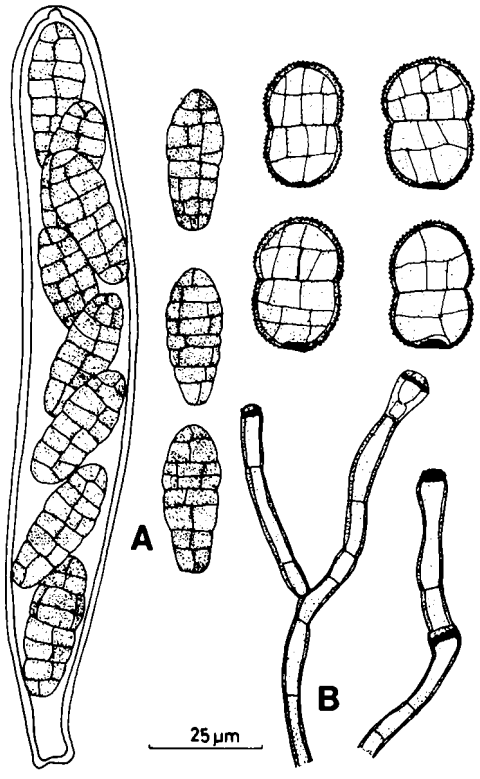


Fig. 311. *Pleospora herbarum* (type). A, ascus and ascospores; B, conidiophores and conidia.

oblong rounded at the ends, broadly ellipsoidal or subspherical, with commonly 3 transverse and 1-3 longitudinal septa, constricted at the median transverse septum, pale to mid dark brown or olivaceous brown, distinctly verruculose or echinulate, 26-42 × 24-30 µm with a large basal scar-like zone surrounding a small pore.

This is a common, plurivorous and cosmopolitan species.

P. media Niessl, *Verh. Naturf. verf. Brunn.* **14:** 188, 1876 (Fig. 312).

Anamorph: *Camarosporium* sp. (Webster & Lucas, 1961).

Pseudothecia scattered up to 450 µm broad. Asci 116-130 × 15-19 µm. Ascospores oblong ellipsoidal, often asymmetrical, with the lower half narrower and tapered, predominantly 5 septate, rarely 7 septate, con-

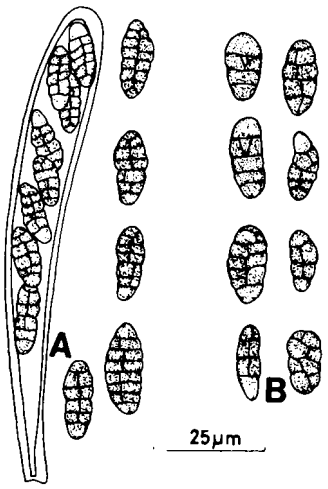


Fig. 312. *Pleospora media.* A, ascus and ascospores; B, conidia.

stricted at the three primary septa, with one vertical septum in all central cells and often in the end cells, golden brown, 20-25 × 10-12 µm, with obtuse ends.

Pycnidia associated with pseudothecia and produced in culture from single ascospore and single conidial isolations (Webster & Lucas, 1961), globose, ostiolate, up to 240 µm broad. Conidia oblong ellipsoidal, ovoid, subglobose, 2-3 septate or cruciately septate, yellowish, 8-14 × 5.5-6 µm or up to 10 µm diam.

On *Aster, Ballota, Echium, Suaeda.* Europe, U.S.A.

P. papaveracea (de Not.) Sacc., *Syll. Fung.* **2:** 243, 1883 (Fig. 313).

Cucurbitaria papveraceae de Not., *Sfer. Ital. Cent. I. Fasc.* **2:** 62, 1863.
Sphaeria papaveris L.R. & C. Tul., *Sel. Fung. Carpol.* **1:** 44, 1861 non Schumacher: Fr., 1828.
Pleospora bardanae Niessl, *Verhandl. Naturf. Ver. in Brunn* **14:** 178, 1876.
Pleospora pellita (Fr.) Rabenh. var. *bardanae* (Niessl) Wehm., *A world monograph of the genus Pleospora and its segregates:* 48, 1961.

Anamorph: *Dendryphion penicillatum* (Corda) Fr., *Summa veg. Scand.* **2:** 504, 1849 (as *'Dendryphium').*

Brachycladium penicillatum Corda, *Icon. Fung.* **2:** 14, 1838.

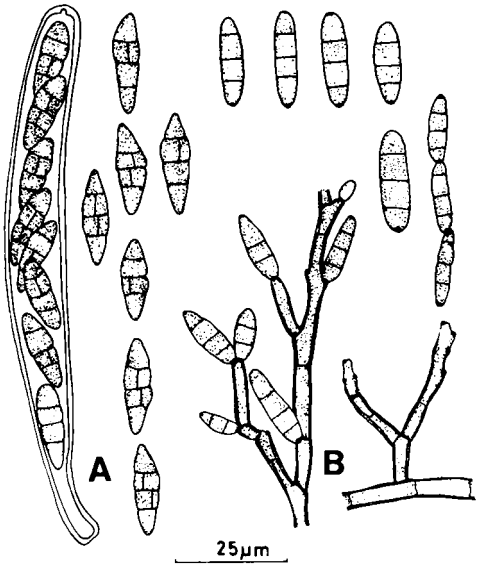


Fig. 313. *Pleospora papaveracea.* A, ascus and ascospores; B, conidiophores and conidia.

Dendryphion papaveris (Saw.) Saw., *Spec. Publ. Coll. Agric. natn Taiwan Univ.* **8:** 200, 1959.
Helminthosporium papaveris Saw., *J. nat. Hist. Soc. Taiwan* **32:** 129, 1917.

Pseudothecia immersed becoming superficial, single or in small groups, globose, up to 400 μm in diam. Asci cylindrical, 4-8 spored, 100-130 × 8-12 μm. Ascospores elliptical, yellow to pale brown, 3 septate with a vertical septum usually in the two central cells, constricted at the septa, 20-25 × 6-9 μm.

Conidial colonies effuse, black, hairy. Stromata formed on stems are composed of groups of few large, dark brown cells. Conidiophores variable, on stems, subulate up to 600 μm long, 14-20 μm thick, tapering towards the apex, dark brown, closely septate, branched and paler towards the apex; on leaves and in culture often semi macronematous, smaller, up to 60 μm long, 4-6 μm thick, pale olive. Conidia solitary or in chains, cylindrical rounded at the ends or obclavate, smooth, pale olive; those borne on macronematous conidiophores usually 3 septate, 17-28 × 5-9 μm but on leaves and in culture they are variable up to 8 septate and 60 μm long.

On Papaveraceae. Europe, Formosa, India, N.America, S.Africa.

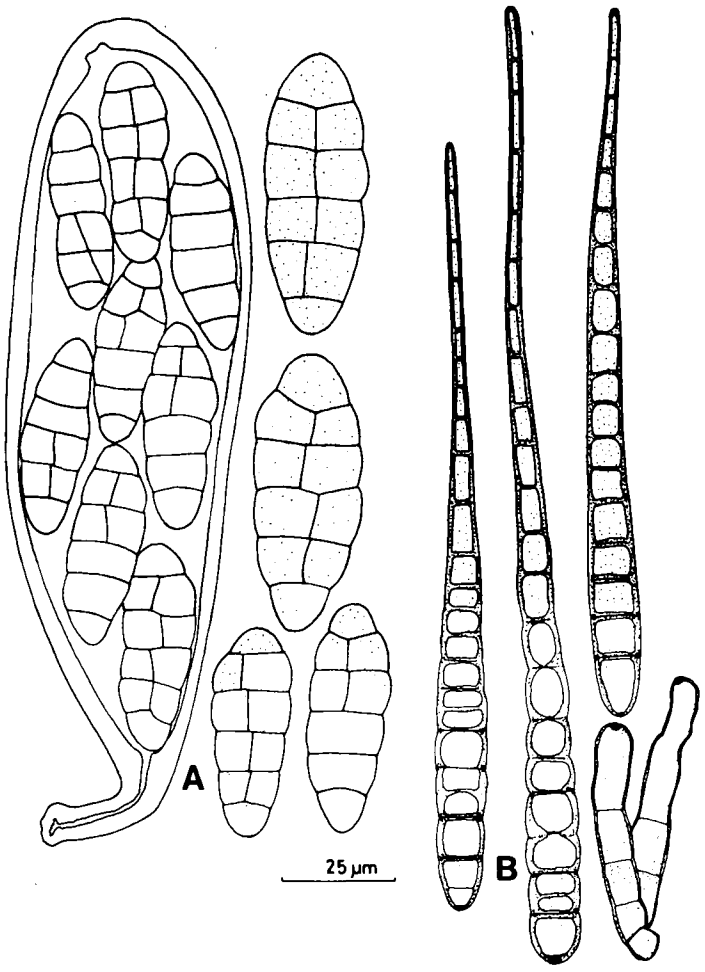


Fig. 314. *Pleospora scirpicola* (type). A, ascus and ascospores; B, conidiophores and conidia.

P. scirpicola (DC.) P. Karsten, *Mycol. Fenn.* **2:** 72, 1873 (Fig. 314).

Sphaeria scirpicola DC., *Fl. fr.* **2:** 300, 1810.
Macrospora scirpi Fuckel, *Symb. mycol.:* 140, 1870.
Macrospora scirpicola (DC.) Fuckel, *Symb. mycol.* **1:** 301, 1871.
Pyrenophora scirpicola (DC.) E. Müller, *Sydowia* **5:** 256, 1951.

Anamorph: *Alternaria scirpicola* (Fuckel) comb. nov.

Sporidesmium scirpicola Fuckel, *Symb. mycol.:* 140, 1870.

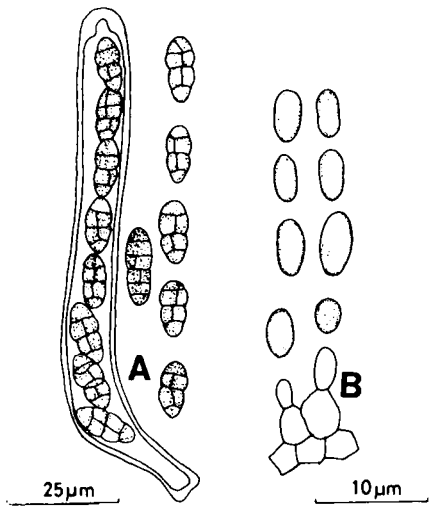


Fig. 315. *Pleospora shepherdiae*. A, ascus and ascospores; B, conidiophores and conidia.

Clasterosporium scirpicolum (Fuckel) Sacc., *Syll. Fung.* **4:** 393, 1886.
Cercospora scirpicola (Fuckel) van Zinderen-Bakker, *Rev. Mycol.* **5:** 6, 1940.

Pseudothecia up to 350 µm broad. Asci 100-180 × 30-35 µm. Ascospores hyaline to yellow brown, oblong to clavate, 4-5 septate with a vertical septum in the second or third cell, frequently slightly flattened, constricted at the median septum, 35-65 × 14-25 µm.

Single ascospore as well as single conidial isolations formed pseudothecia (homothallic) and conidia (Webster & Lucas, 1961). Conidial colonies effuse, dark brown. Conidiophores often in fascicles, golden brown or straw coloured. Conidia mostly obclavate, rostrate, cylindrical or fusiform, rounded at the base, tapering to a whip-like apex, 3-22 septate or distoseptate, occasionally with one vertical or oblique septum, 40-300 × 12-16 µm.

On *Cyperus, Eleocharis, Scirpus*. Europe, India.

P. shepherdiae Peck, *Rep. N.Y. St. Mus.* **40:** 71, 1887 (Fig. 315).

Pleospora carpinicola Ell. & Ev., *Proc. Acad. Nat. Sci. Philad.* **1893:** 135, 1893.
Pleospora juglandis Ell. & Ev., *Bull. Torrey bot. Club* **24:** 278, 1897.
Karstenula carpinicola (Ell. & Ev.) Berl., *Icon. Fung.* **2:** 4, 1900.

Anamorph: *Coniothyrium* sp. (Webster & Lucas, 1961).

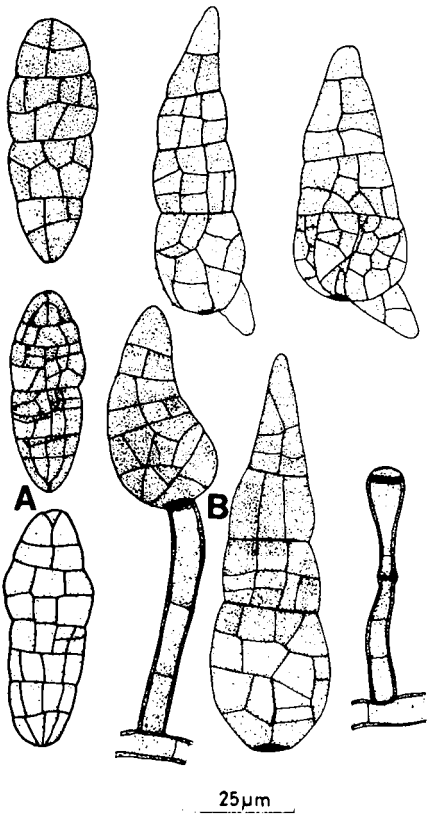


Fig. 316. *Pleospora triglochinicola* (type). A, ascospores; B, conidiophores and conidia.

Pseudothecia up to 600 µm broad. Asci 100-124 × 11-13 µm. Ascospores uniseriate, oblong-elliptical, symmetrical and with the lower half tapered, ends rounded, 3 septate (rarely 4-5), constricted at the middle, one or two of the central cells with one vertical septum, or rarely in an end cell, light brown, 15-22 × 6.5-9 µm.

Webster & Lucas (1961) obtained pycnidia from single ascospore isolations. Pycnidia fusoid, single or in groups, globose, up to 360 µm broad. Conidia elliptical, ovoid or globose, brownish yellow, 4-6 × 2.5-3 µm.

On *Carpinus, Crataegus, Juglans, Lindera, Shepherdia.* Canada, Great Britain, U.S.A.

P. triglochinicola J. Webster, *Trans. Br. mycol. Soc.* **53:** 481, 1969 (Fig. 316).

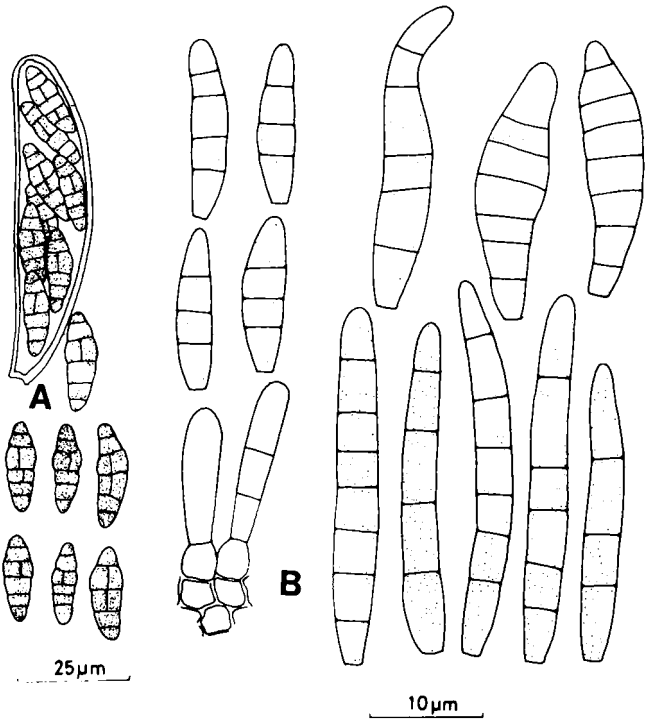


Fig. 317. *Pleospora vagans*. A, ascus and ascospores; B, conidiophores and conidia.

Pleospora maritima Rehm, *Hedwigia* **35:** 149, 1896 non *P. maritima* Bomm., Rouss. & Sacc., *Syll. Fung.* **9:** 893, 1891, non *P. triglochinis* Har. & Briard., *Rev. Mycol.* **12:** 132, 1890.

Anamorph: *Stemphylium triglochinicola* B. Sutton & Piroz., *Trans. Br. mycol. Soc.* **46:** 519, 1963.

Pseudothecia scattered immersed becoming superficial, depressed, globose with a short neck, up to 400 µm broad. Asci 150-175 × 40-45 µm. Ascospores distichous in the ascus, slipper shaped, slightly or not broader at the upper end, typically with 7 transverse septa with 1-2 complete or nearly complete unthickened septa in most segments apart from the end cells which are usually divided by a single longitudinal septum, golden brown to mid brown, surrounded by a mucilaginous sheath, 46-65 × 16-24 µm.

Conidial colonies effuse, light brown to mid brown. Conidiophores up to 175 µm long, 6-12 µm thick. Conidia formed singly at the apex of

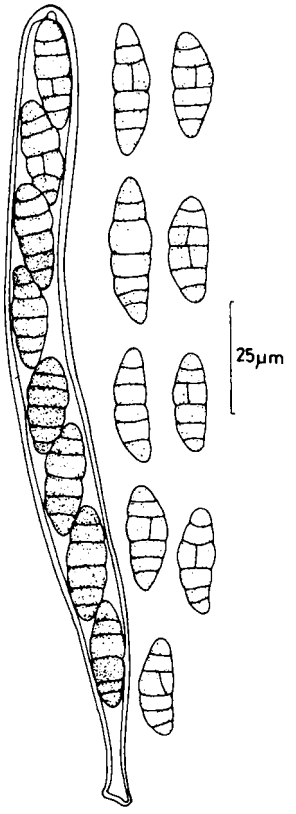


Fig. 318. *Pleospora vagans* var. *spartinae* (type). Ascus and ascospores.

each conidiophore which afterwards proliferates through the apex to form another conidium at a higher level, obclavate, with up to 10 transverse septa and 4 longitudinal septa, eventually distinctly trigonous or obturbinate with a long apical beak and a single short lateral beak formed on one side of the prominent dark brown basal scar, 2-3 major horizontal septa and 1-3 major vertical septa with many secondary septa develop in all directions to form a conidium which is 4-6 cells thick at the base tapering to one cell in thickness at the two beaks, pale brown 45-80 × 18-46 µm.

On dead leaves of *Triglochin*. Europe.

P. vagans Niessl, *Verh. Naturf. Ver. Brünn.* **14:** 174, 1876 (Fig. 317).

Anamorph: *Stagonospora* sp. (*Hendersonia* sp.)

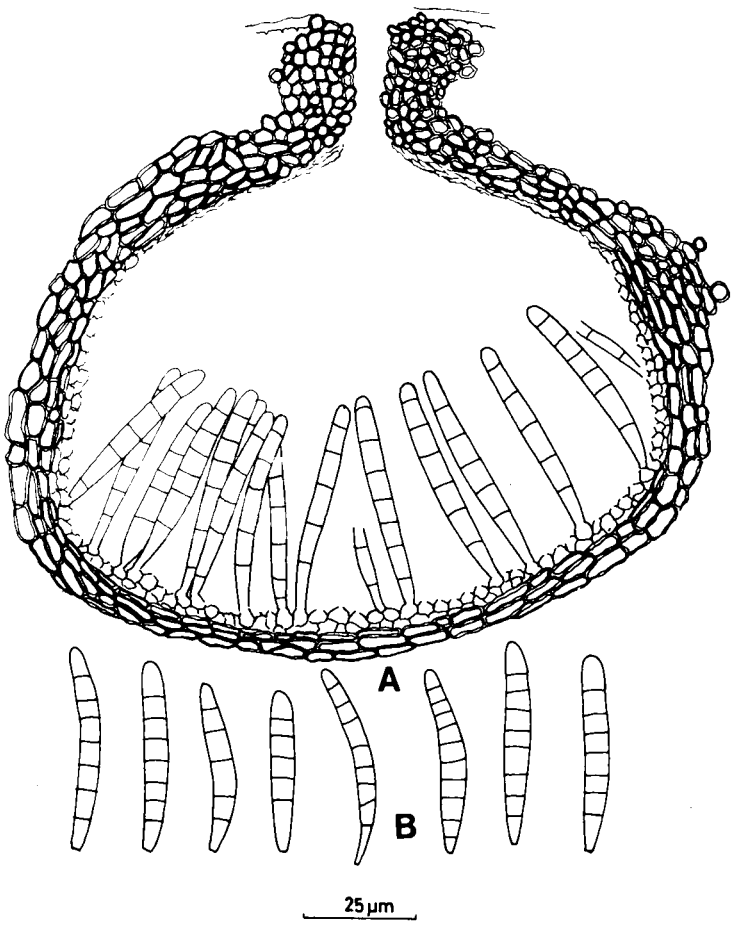


Fig. 319. *Pleospora vagans* var. *spartinae*. A, v.s. pycnidia; B, conidia.

Pseudothecia up to 220 µm broad. Asci 90-125 × 14-16 µm. Ascospores yellow brown, 5 (rarely 6) septate, with a vertical septum in one or more of the four central cells or occasionally without any vertical septa, 22-28 × 7-9.5 µm, with the third cell from above somewhat wider.

Pycnidia produced in culture from single ascospore isolations (Webster, 1955a), up to 110 µm broad, globose or flattened globose, ostiolate. Conidia pale brown in mass, hyaline when young, later yellow to yellowish brown, 3-7 (14) septate, slightly constricted at the septa, cylindrical, straight or slightly curved, tapering above and abruptly truncate at the base, guttulate, 24-46 × 4-7 µm, formed on short obpyriform, smooth one celled conidiogenous cells lining the cavity of the pyc-

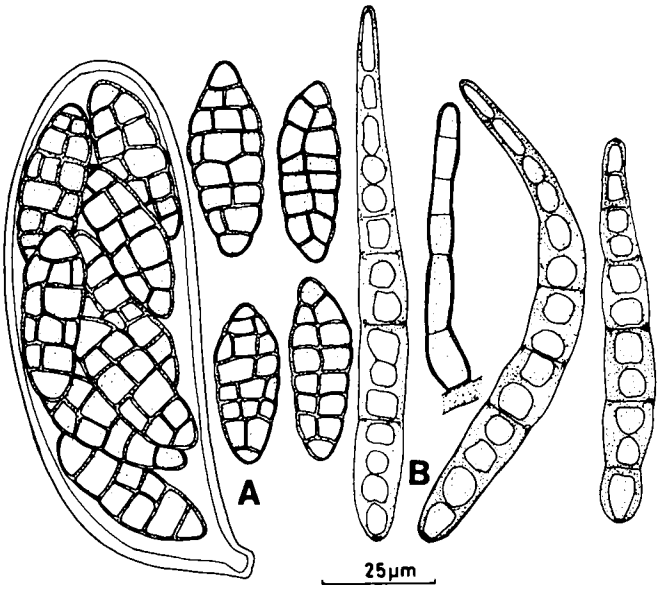


Fig. 320. *Pleospora valesiaca.* A, ascus and ascospores; B, conidiophore and conidia.

clematidis Trav. is the possible anamorph but in the absence of pycnidia on the host it is difficult to be certain of this.

nidium. Webster (1955a) considered *Hendersonia crastophila* Sacc. as the possible species to which the anamorph may be placed.

On a wide variety of graminicolous hosts. Europe, U.S.A.

P. vagans Niessl var. **spartinae** Webster & Lucas, *Trans. Br. mycol. Soc.* **44:** 427, 1961 (Figs. 318, 319).

Pseudothecia associated with black discoloration of the host tissues. Asci 150-180 × 14-18 µm. Ascospores typically 5 septate, sometimes 6 septate, constricted at the septa, especially at the middle, with vertical septa in the third and fourth cells, or occasionally lacking, third cell wider than the rest, boat shaped, sometimes slightly inequilateral, yellowish brown, 26-32 × 12-13 µm.

Webster & Lucas (1961) obtained pycnidia from single ascospore isolations. Pycnidia subepidermal, globose, Conidia cylindrical and somewhat tapering at both ends, 5-7 septate, faintly constricted at some septa, straight or slightly curved, yellow to pale brown, guttulate, 36-72 × 3-6 µm. Similar pycnidia also found on hosts.

This species differs from *P. vagans* in the longer asci and larger and thicker walled ascospores.

On *Spartina townsendii*. Great Britain.

P. valesiaca (Niessl) E. Müller, *Sydowia* **5:** 269, 1951 (Fig. 320).

Pleospora discor (Dur. & Mont.) Ces. & de Not. var. *valesiaca* Niessl, *Verh. Naturf. Ver. Brünn.* **14:** 185, 1876.

Anamorph: *Alternaria* sp.

Pseudothecia up to 225 μm broad. Asci 110-140 × 34-40 μm. Ascospores oblong, fusoid, yellow to dark brown, 6-10 mostly 7 septate with 1 or more vertical septa in all but the end cells, 34-58 × 14-21 μm.

Conidial colonies effuse, grey to dark brown. Conidiophores single or in pairs, pale mid brown to straw coloured. Conidia mostly obclavate, rostrate, beaked, often constricted, pale straw coloured, with up to 13 distoseptate or septate, 84-180 × 11-14 μm.

On *Carex* and *Juncus*. Europe.

P. vitalbe (de Not.) Berl., *Nuovo G. bot. Ital.* **20:** 70, 1888 (Fig. 321).

Sphaeria vitalbe de Not., *Mem. Acad. Torino* **13:** 32, 1853.
Leptosphaeria vitalbe (de Not.) Winter in Kunze, *Fungi sel.* No. 331, 1880.
Teichospora vitalbe (de Not.) Sacc., *Fungi Ven.* **5:** 177, 1876 non Niessl 1869 and Rehm 1858.
Leptosphaeria pleosporoides Auersw. in Rabenh., *Hedwigia* **6:** 88, 1869.
Pleospora clematidis Fuckel, *Symb. mycol.:* 132, 1870.

Anamorph: *Stagonospora* sp. As *Hendersonia* sp., Webster & Lucas, 1961.

Pseudothecia immersed in rows up to 400 μm broad. Asci 100-130 × 9-10 μm. Ascospores uniseriate, oblong fusoid, 3-5 (mostly 5) septate with a vertical septum in one or both the central cells, slightly constricted at the septa, third cell from above enlarged, golden brown, 19-23 × 6-7 μm.

Webster & Lucas (1961) produced pycnidia from single ascospore isolations. Pycnidia globose, ostiolate, simple or stromatic, up to 560 μm broad. Conidia oblong, often tapering towards the apex or irregularly ellipsoidal, 3 septate, pale brown, 12-16 × 3-5 μm.

According to Webster & Lucas (1961) *Hendersonia sarmentorum* var.

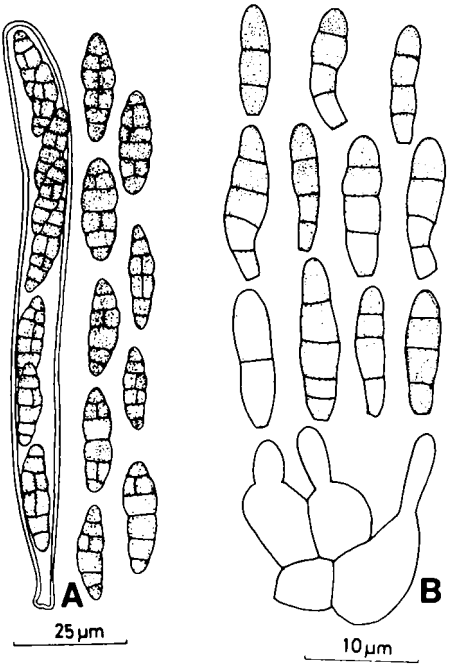


Fig. 321. *Pleospora vitalbe.* A, ascus and ascospores; B, conidiophores and conidia.

On dead stems of *Clematis vitalbe, Ilex.* Argentina, Europe.

I have refrained from giving specific epithets to *Pleospora* sp. mentioned below as Dr. E.G. Simmons (personal communication) is making a detailed study of them and the results of his study are expected in the near future. However, descriptions are included because they are commonly encountered at least in their conidial states.

Pleospora sp. I. (Fig. 322).

Anamorph: *Stemphylium globuliferum* (Vestergren) E. Simmons, *Mycologia* **61:** 14, 1969.

Macrosporium globuliferum Vestergren, *Bih. Svenska Vet. Akad. Handl.* **6:** 27, 1896.

Pseudothecia stromatic formed in culture from conidial isolates (Simmons, 1969), tomentose, seldom exceeding 0.5 mm with a short

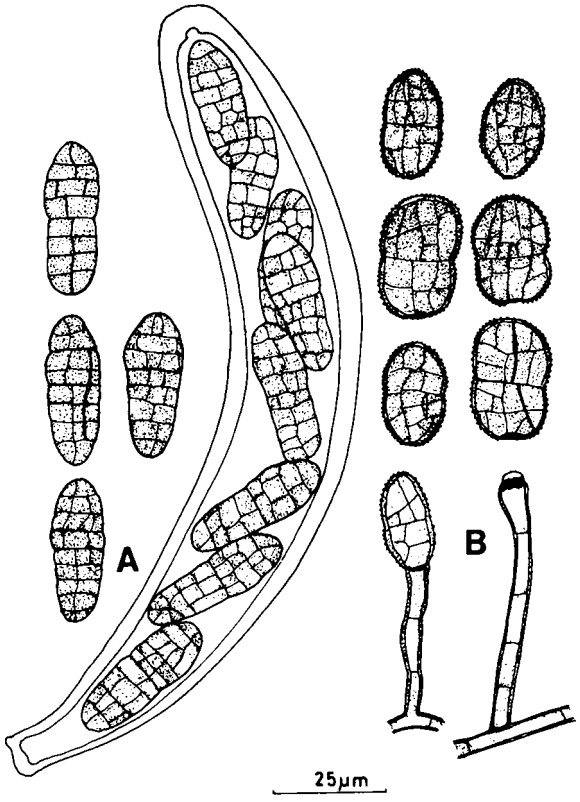


Fig. 322. *Pleospora* sp. I. A, ascus and ascospores; B, conidiophore and conidia.

conical beak. Asci up to 250 µm long and 50 µm wide. Ascospores commonly 7 septate with 1 or more incomplete vertical septa, deep red brown, the upper half slightly broader than the lower half, constricted at the three major transverse septa, up to 45 µm long and 20 µm wide.

Conidiophores with 1-5 percurrent proliferations, swollen at the base, up to 70 µm long, 5-7 µm thick. Conidia oblong, ovoid, broadly ovoid or subspherical, with 1-3-4 transverse and 3-4 complete or nearly complete series of longitudinal septa, distinctly constricted at the median septum, dilute to mid yellow brown, when fully developed, 28-30 × 25-28 µm with external wall verrucose and with a distinctly darkened basal scar-like zone.

Common on herbaceous legumes and other hosts. Australia, Egypt, India, Israel, Oman, U.S.A.

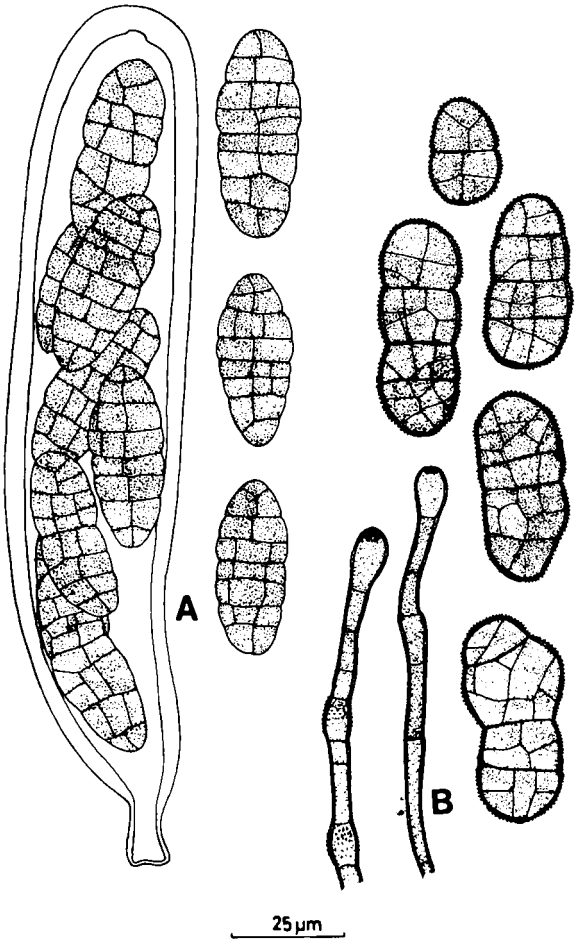


Fig. 323. *Pleospora* sp. II. A, ascus and ascospores; B, conidiophores and conidia.

Pleospora sp. II (Fig. 323).

Anamorph: *Stemphylium majusculum* E. Simmons, *Mycologia* **61:** 16, 1969.

Pseudothecia formed in culture at refrigerator temperatures within 4-6 months (Simmons, 1969) from conidial isolates, up to 1 mm broad, without a distinct beak. Asci up to 160 µm long and 38 µm wide. Ascospores oblong with rounded ends, with 7 septa and one complete or numerous incomplete vertical septa, constricted at the three major transverse septa, yellow to yellow brown up to 30 µm long and 13 µm wide.

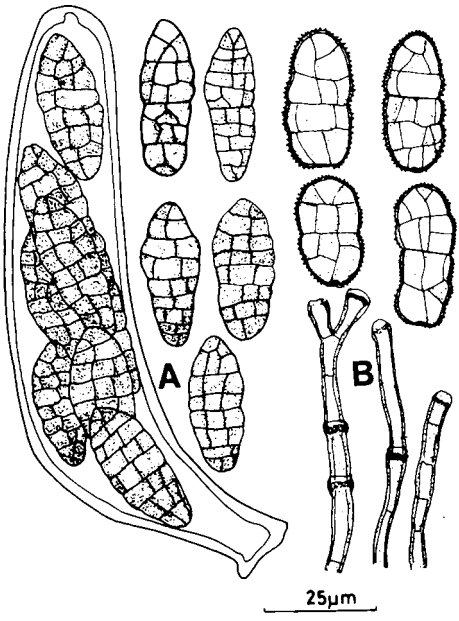


Fig. 324. *Pleospora* sp. III. A, ascus and ascospores; B, conidiophores and conidia.

Conidiophores with 1-3 apical proliferations which are swollen or flared, mid yellow brown to mid brown, smooth, except for definite echinulation of the apical cell, septate, up to 100 µm long, 8-10 µm thick at the broadest part. Conidia oblong or broadly ovoid, 1-9 transversely septate and 1-5 complete or nearly complete series of longitudinal septa, distinctly constricted at 1-3 major transverse septa, dilute brown to mid yellow brown, when fully developed 50-65 × 30-35 µm, verrucose, with a conspicuous darkened basal zone.

On moribund leaves of *Lathyrus maritimus*. U.S.A.

Pleospora sp. III (Fig. 324).

Anamorph: *Stemphylium vesicarium* (Wallr.) E. Simmons, *Mycologia* **61:** 9, 1969.

Helminthosporium vesicarium Wallr., *Fl. Crypt. Germ.* **2:** 166, 1833.
Macrosporium parasiticum Thüm., *Mycotheca Universalis* Cent. VII, No. 667, 1877.
Macrosporium vesicarium (Wallr.) Sacc., *Syll. Fung.* **4:** 537, 1886.

Mystrosporium alliorum Berk. & Sacc., *Syll. Fung.* **4:** 541, 1886.
Macrosporium alliorum Cooke & Massee in Cooke, *Grevillea* **16:** 80, 1888.
Macrosporium sarcinula Berl. var. *parasiticum* (Thüm.) Thaxter, *Conn. Agr. Expt. Stn, Ann. Rep.* **1889:** 158, 1890.
Stemphylium allii Oudem., *Beih. Bot. Centr.* **11:** 539, 1902.
Macrosporium caepicola Speg., *An. Mus. Nac. B. Aires* **20:** 444, 1910.
Stemphylium parasiticum (Thüm.) Elliott ex A.W. Henry, *Minn. Agr. Expt.Stn Tech. Bull.* **22:** 43, 1924.
Thyrospora parasitica (Thüm.) Angell, *J. Agric. Res.* **38:** 473, 1929.

Pseudothecia formed in culture from conidial isolates at refrigerator temperatures within 3-6 months (Simmons, 1969), stromatic, up to 0.5 mm broad with long beaks. Asci up to 170 μm long and 35 μm wide. Ascospores with 7 septa and with numerous rarely complete vertical septa, pale yellow to brown, up to 38 μm long and 18 μm wide.

Conidiophores often caespitose, up to 70 μm long, 3-8 μm thick, with smooth or minutely verruculose dark bands at the vesicular swelling. Conidia oblong rounded at the ends or broadly ellipsoidal, pale to mid brown or olivaceous brown, with up to 6 septa and several vertical septa, often constricted at the 3 major transverse septa, 20-50 × 15-26 μm.

On dead herbaceous stems. Africa, Europe, N. and S. America.

Pleospora allii (Rabenh.) Ces. & de Not. is believed to be the teleomorph of *S. vesicarium.*

PYRENOPHORA Fr., *Summa veg. Scand.:* 397, 1849.

Macrospora Fuckel, *Symb. mycol.:* 139, 1870.
Polytrichia Sacc., *Syll. Fung.* **1:** 451, 1882.
Neilreichina Kuntze, *Rev. Gen. Pl.* **2:** 862, 1891.

Type sp.: *P. phaeocomes* (Rebent.) Fr., *Summa veg. Scand.:* 398, 1849.

Anamorph: *Drechslera* Ito (= sub genus *Cylindro-Helminthosporium* Nisikado). For a description of this genus see under *Cochliobolus.*

Pseudothecia solitary, scattered, immersed to erumpent becoming almost superficial, globose to flattened globose, ellipsoidal or pyriform, black, sclerotioid when young, smooth or often bearing dark brown setae on the upper surface, with a short papillate, rounded ostiole. The pseudothecial wall dark brown to black ot textura angularis is composed

of thick-walled dark brown cells on the outermost layer and progressively thin-walled, hyaline cells toward the inside. Asci thick-walled, short stalked, broadly clavate to somewhat saccate, up to 8 spored, with a large nasse apicale which is apically surrounded by a large non amyloid ring. Ascospores irregularly biseriate in the ascus, large, hyaline to pale yellow or yellowish brown, mostly smooth, rarely slightly verrucose, dictyosporous with 1-2 vertical septa in one or all the cells, slightly constricted at the septa, with or without a mucilaginous sheath. Pseudoparaphyses indefinite, filiform, branched, anastomosing, completely filling the central pseudothecial cavity. Pseudothecia mature only after overwintering.

Pycnidial state (spermogonia) when present is superficial or partly immersed, globose to pyriform, ostiolate, often setose and with conidiophores. Conidia (spermatia) hyaline, spherical or ellipsoidal, one celled, excluded in a slimy grey white mass.

About twelve species (Ammon, 1963; Eriksson, 1967a). The non amyloid ring in the ascus is most readily seen in blue ink or Congo red mounts (Eriksson, 1967a). Such rings have also been seen in *Pleospora* and *Wettsteinia* Höhnel. *Pyrenophora* differs from the closely allied *Clathrospora* Rabenh. and *Platyspora* Wehm. in having non flattened ascospores and from *Pleospora* in the smaller ascospores and in not having definite pseudoparaphyses.

Key to Pyrenophora species with Drechslera anamorph

Conidiophores formed on large, erect, black stromata..... *P. semeniperda*

Conidiophores not formed on erect stromata..... 1

1. Basal cell of the conidium conical..... *P. tritici-repentis*

   Basal cell of the conidium rounded..... 2

2. Conidia with end cells often paler than the central cells..... *P. tetrarrhenae*

   Conidia uniformly pigmented throughout..... 3

3. Conidia not more than 16 μm wide..... *P. erythrospila*

   Conidia usually more than 16 μm wide..... 4

4. Conidia not more than 130 μm long..... 5

   Conidia usually more than 130 μm long..... 7

5. Conidia less than 67 μm long..... *P. phaeocomes*

   Conidia usually more than 67 μm long..... 6

6. Secondary conidiophores and conidia frequently formed..... *P. graminea*

   Secondary conidiophores and conidia not formed..... *P. avenae*

7. Conidia usually less than 170 μm long..... 8

   Conidia usually more than 170 μm long..... 9

8. Conidia 3-9 distoseptate, rounded at both ends..... *P. teres*

   Conidia 3-11 distoseptate, slightly tapering at one or both ends..... *P. lolii*

9. Conidia not more than 210 μm long..... *P. japonica*

   Conidia usually more than 210 μm long..... 10

10. Conidia rounded or slightly narrowing at the ends..... *P. bromi*

    Conidia tapering uniformly at the apex..... *P. dictyoides*

P. avenae Ito & Kurib. in Ito, *Proc.imp.Acad.Japan* **6:** 354, 1930 (Fig. 325).

Anamorph: *Drechslera avenae* (Eidam) Scharif, *Studies on graminicolous species of Helminthosporium, Teheran:* 72, 1963.

Helminthosporium avenae Eidam, *Landwirt, Breslau* **27:** 509, 1891.

Pseudothecia with many long setae, up to 800 μm broad and 600 μm high. Asci 2-8, mostly 4-8 spored, 180-360 (400) × 32-45 (60) μm. Ascospores hyaline to light yellow brown, ellipsoidal to broadly cylindrical, rounded at both ends, transversely 3-6 (mostly 5) septate, without or with 1-4 longitudinal septa in the central cells, constricted at the septa 35-75 × 17-30 μm, enclosed in a mucilaginous sheath.

Conidiophores single or in groups, mostly cylindrical, straight or flexuous, geniculate, swollen at the base, smooth, brown, up to 350 μm long, 8-12 μm thick. Conidia single, rarely in chains, straight, cylindrical, rarely obclavate, sometimes slightly tapered, smooth, pale to olivaceous brown, 1-9 distoseptate and 50-130 × 15-20 μm on the host, in culture 2-5 distoseptate and 30-60 × 12-15 μm; with a hilum 3-6 μm wide. No protothecia formed in culture. Characteristic white, splayed out 'coremia' appear in culture.

On oats (*Avena*) and occasionally on other grasses. Cosmopolitan, causing eye spots. For a brief description of the disease refer to Ellis & Waller (1973b).

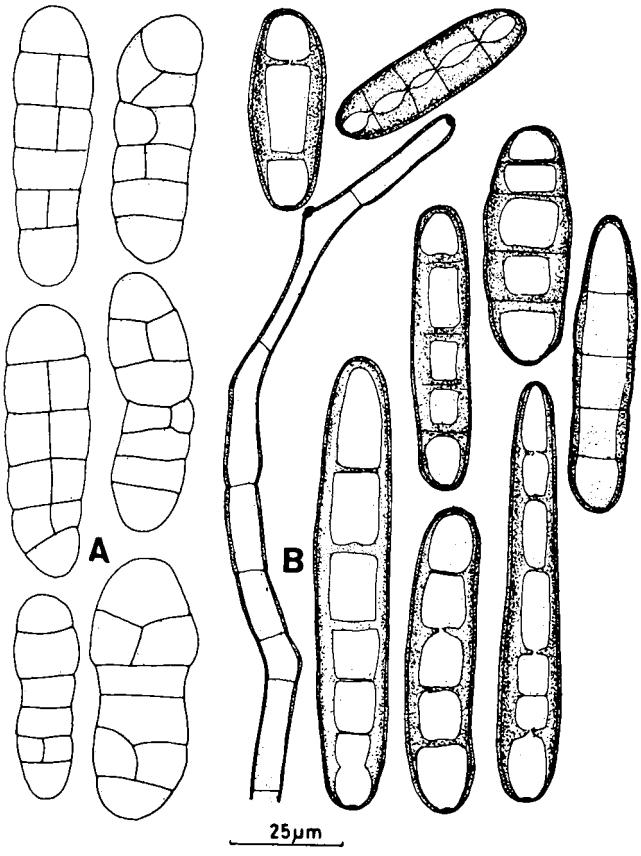


Fig. 325. *Pyrenophora avenae.* A, ascospores; B, conidiophore and conidia.

P. bromi (Died.) Drechsler, *J. agric. Res.* **24:** 672, 1923 (Fig. 326).

Pleospora bromi Died., *Zentbl. Bakt. ParasitKde, Abt. 2,* **11:** 52, 1903.
Pleospora trichostoma (Fr.) Ces. & de Not. f. sp. *bromi* (Died.) Noack., *Zeitschr. Pflanzenkrankh.* **15:** 193, 1905.

Anamorph: *Drechslera bromi* (Died.) Shoem., *Can.J.Bot.* **37:** 881, 1959.

Helminthosporium gramineum Rabenh. ex Schlecht. f. sp. *bromi* Died., *Zentbl. Bakt. ParasitKde, Abt.* 2, **9:** 329, 1902.
Helminthosporium bromi (Died.) Died., *Zentbl. Bakt. ParasitKde, Abt.* 2, **11:** 56, 1903.

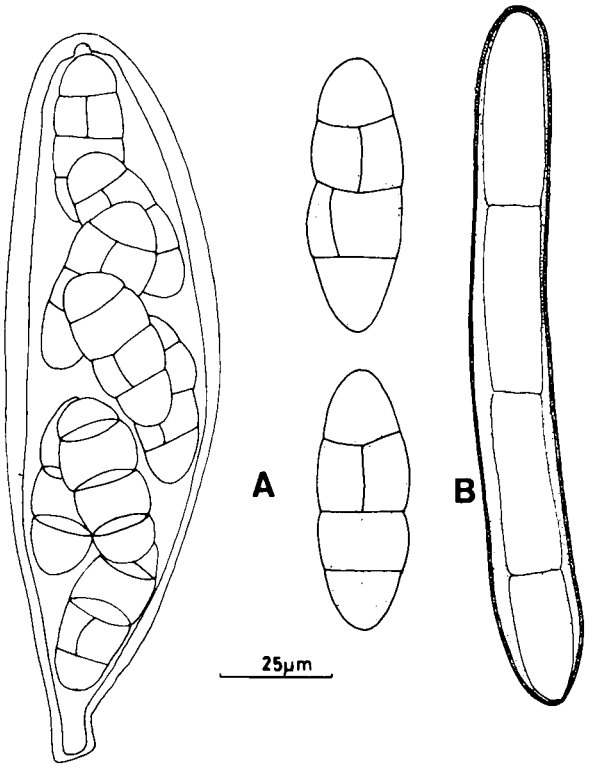


Fig. 326. *Pyrenophora bromi.* A, ascus and ascospores; B, conidium.

Pseudothecia depressed conical, short beaked, usually smooth, rarely setose. Asci mostly 8 spored, 160-250 (300) × 39-45 (55) µm. Ascospores hyaline to yellow brown, transversely 3 septate, without or with a longitudinal septum in one or both the central cells, 48-69 (72) × 14-23 (30) µm, enclosed in a mucilaginous sheath.

Conidiophores single or in pairs, yellowish brown, sub-hyaline near the apex, erect, simple, straight or flexuous, up to 300 µm long, 7-11 µm thick, swollen at the base. Conidia straight, cylindrical, smooth, slightly narrowing at the ends or rounded, 2-10 (commonly 4-8) distoseptate, sub-hyaline to pale yellow brown, 100-250 × 14-26 µm, with an inconspicuous hilum.

On *Bromus* causing dark brown spots with a yellow halo. The spots elongate and coalesce, finally the leaves turn yellow and wither. Australia, Europe and North America.

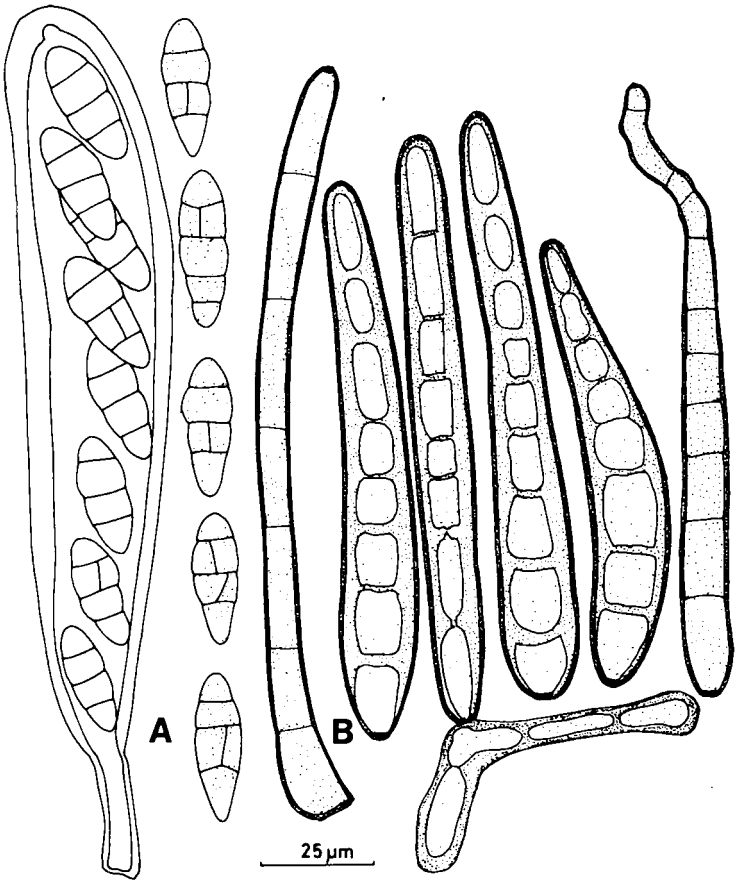


Fig. 327. *Pyrenophora dictyoides* (type). A, ascus and ascospores; B, conidiophores and conidia.

P. dictyoides Paul & Parbery, *Trans.Br.mycol.Soc.* **51:** 708, 1968 (Fig. 327).

Anamorph: *Drechslera dictyoides* (Drechsler) Shoem., *Can.J.Bot.* **37:** 881, 1959.

Drechslera dictyoides (Drechsler) Shoem. f. sp. *dictyoides* Shoemaker, *Can.J. Bot.* **40:** 821, 1962).
Helminthosporium dictyoides Drechsler, *J.agric.Res.* **24:** 679, 1923.
Helminthosporium dictyoides f. sp. *perennis* Braverman & Graham, *Phytopathology* **50:** 695, 1960 ('as *perenne*')
Drechslera dictyoides f. sp. *perennis* (Brav. & Graham) Shoem., *Can.J.Bot.* **40:** 821, 1962 (as '*perenne*').

Pseudothecia setose near the apex, unbeaked, elliptical to semicircular, up to 680 μm broad and 380 μm high. Asci usually 8 spored, 200-300 × 35-57 μm. Ascospores hyaline to light brown, naviculate, bluntly rounded at both ends, transversely 3 septate, rarely 4 septate with 1 or 2 longitudinal septa in the central cells, constricted, 33-55 × 15-24 μm.

Conidiophores emerging through the stomata, single or in groups, straight or flexuous, simple, mid to olivaceous or dark brown, sometimes geniculate, base swollen, up to 250 μm long, 6-12 μm thick. Conidia solitary on natural substrate but often catenate in culture, cylindrical, tapering uniformly towards the apex, straight, pale to yellowish brown, smooth, 0-15 (usually 4-7) distoseptate, 20-250 μm long, 14-20 μm in the broadest part, 6-9 μm at the apex, scar dark, 3-5 μm wide. Occasionally conidia are forked.

On *Festuca pratensis* causing net-blotch lesions and occasionally on *Lolium* and other grasses. Australia, Europe, N.America. Ellis & Waller (1976a) have illustrated and described the anamorph of this species together with notes on the disease and transmission.

P. erythrospila Paul, *Trans.Br.mycol.Soc.* **59:** 99-100, 1972 (Fig. 328).

Anamorph: *Drechslera erythrospila* (Drechsler) Shoem., *Can.J.Bot.* **37:** 880, 1959.

Helminthosporium erythrospilum Drechsler, *Phytopathology* **25:** 344, 1935.

Pseudothecia immersed to superficial, setose around the apex, up to 1260 μm in diam. Asci 2-8 spored, commonly 4 or 6 spored, 190-315 × 22-38 μm. Ascospores ellipsoidal, light yellow brown, broadly rounded at the ends, dictyoseptate with 3 transverse septa and 0-2 longitudinal septa, sometimes up to 5 transverse septa, 33-70 × 18-28 μm. Prototheca often formed in culture.

Conidiophores single or in pairs, cylindrical, sometimes repeatedly geniculate near the apex, mid to dark brown, unbranched, swollen at the base, up to 340 μm long, 6-8 μm thick. Conidia straight or sometimes curved, cylindrical or almost cylindrical, rounded at the ends, yellowish to pale olivaceous brown, 2-10 distoseptate, most commonly 4-6 distoseptate, 40-70 × 11-13 μm, rarely 100 × 16 μm with a prominent black hilum; the basal cell may be cut off by a dark brown transverse septum.

On *Agrostis* and other grasses, sometimes causing straw-coloured spots; Australia, Europe, U.S.A.

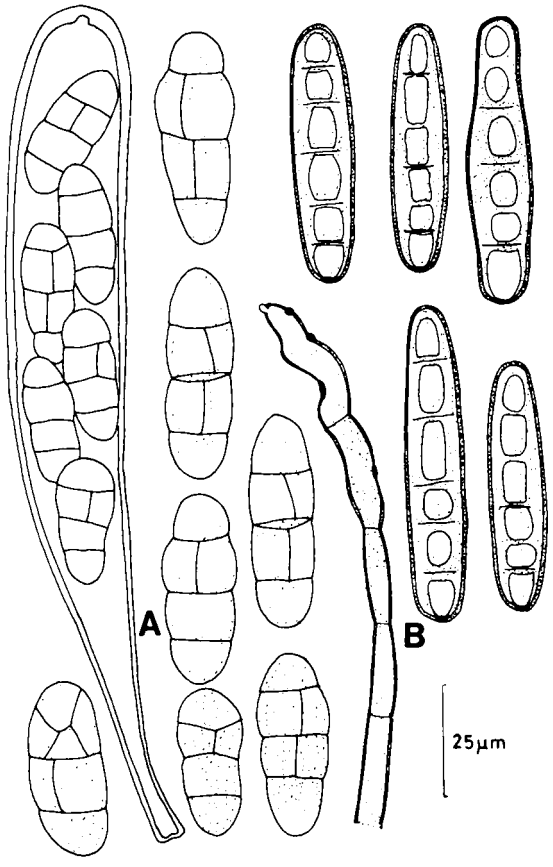


Fig. 328. *Pyrenophora erythrospila* (type). A, ascus and ascospores; B, conidiophore and conidia.

P. graminea Ito & Kurib. in Ito, *Proc.imp.Acad.Japan* **6:** 353, 1930 (Fig. 329).

Pyrenophora graminea (Died.) E. Müller, *Sydowia* **5:** 255, 1951.
Pleospora graminea Died., *Centbl.Bakt.ParsitKde Abt. 2,* **11:** 56, 1903.

Anamorph: *Drechslera graminea* (Rabenh.) Shoem., *Can.J.Bot.* **37:** 881, 1959.

Helminthosporium gramineum Rabenh., Klotzsch *Herb. mycol. ed. 2 Cent.* 4, No. 332, 1857 (*Bot. Ztg.* **15:** 94, 1857).
Brachysporium gracile (Wallr.) Sacc. var. *gramineum* (Rabenh. ex Schlecht.) Sacc., *Syll. Fung.* **4:** 430, 1886.

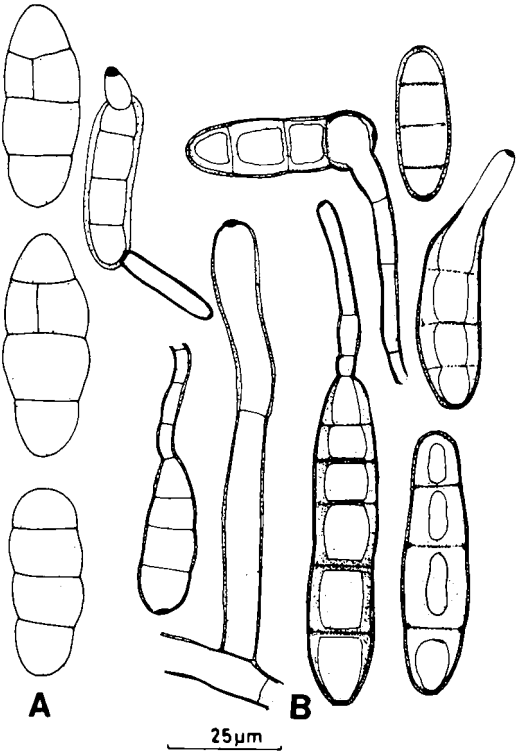


Fig. 329. *Pyrenophora graminea.* A, ascospores; B, conidiophore and conidia.

Napicladium hordei Rostrup, *Sygdomme nos landbrugsplanter foraarsagede of snyltesvampe:* 130-132, 1893.

Pseudothecia setose, immersed at first then becoming superficial, globose when young, later developing a conical to flask-shaped beak, up to 800 µm broad and 600 µm high. Asci 1-8 spored, mostly 4 or 8 spored, 200-425 × 28-45 µm. Ascospores yellowish brown, ellipsoidal, rounded at both ends, transversely 3 septate, without or with 1 or 2 longitudinal septa in the central cells, constricted at the septa, 45-75 × 20-33 µm.

Conidiophores in groups, straight or flexuous, pale to yellowish brown, swollen at the base, septate, up to 250 µm long. Conidia subcylindrical but frequently broader in the basal part and tapering slightly towards the apex, ends rounded, rarely curved, subhyaline to golden brown, 1-7 distoseptate, 40-110 (commonly 50-80) × 14-23 µm with a dark brown hilum. Secondary conidiophores bearing conidia produced from apical and basal cells. Pycnidia globose, up to 176 µm broad, superficial to

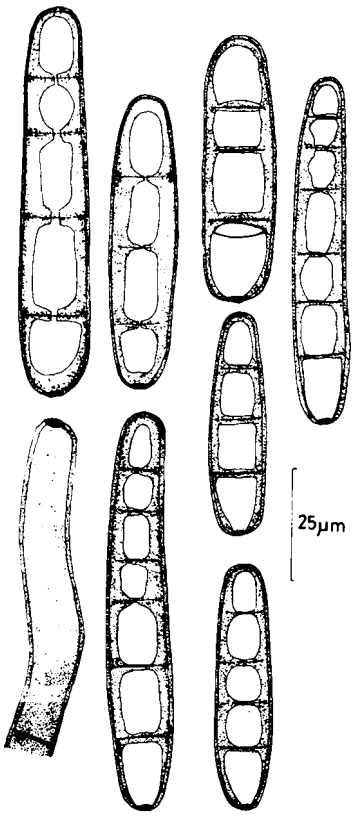


Fig. 330. *Pyrenophora japonica.* Conidiophore and conidia.

partly immersed in infected straw with few setae. Pycnospores hyaline, one celled, ellipsoidal or spherical, 1.4-3.2 × 1-1.5 µm. The pseudothecial and pycnidial states have been described by Smedegard-Petersen (1972).

Causes leaf stripe disease of barley. Cosmopolitan. A brief note on the disease, transmission and control is given by Ellis & Waller (1973a).

P. japonica Ito & Kurib. in Ito, *Proc.imp.Acad.Japan* 6: 353, 1930 (Fig. 330).

P. secalis Whitehead & Dickson, *Mycologia* **44:** 752, 1952.

Anamorph: *Drechslera tuberosa* (Atk.) Shoem., *Can.J.Bot.* **37:** 881, 1959.

Helminthosporium tuberosum Atk., *Bull.Corn.Univ.* **3:** 47, 1897.
Helminthosporium fragosii Bubak, *Hedwigia* **57:** 13, 1915.
Helminthosporium japonicum Ito & Kurib., *J.Fac.Agric.Hokkaido Univ. Japan* **29:** 108, 1951.
Helminthosporium secalis Whitehead & Dickson, *Mycologia* **44:** 757, 1952.
Drechslera japonica (Ito & Kurib.) Shoem., *Can.J.Bot.* **37:** 881, 1959.

Pseudothecia flask shaped or conical, up to 700 μm wide and 600 μm long, setose. Asci 225-350 (400) × 35-45 μm, 8 spored. Ascospores hyaline to yellowish brown, ellipsoidal, rounded at both ends, transversely 3 septate without or with 1 or 2 longitudinal septa in the central cells, constricted at the septa, 40-65 × 17.5-30 μm.

Conidiophores amphigenous, single or in small groups, straight or sometimes curved, dark brown, erect, septate, up to 400 μm long and 11-18 μm thick at the broadest part, base swollen, apex slightly tapering. Conidia dark yellowish brown, with a dark brown thick scar, cylindrical, straight, rounded at both ends, 3-9 distoseptate, commonly 4-6 distoseptate, 45-210 × 12-25 μm commonly 50-145 × 16-22 μm. Secondary conidiophores and conidia frequently formed from one or both end cells.

On *Hordeum* and other graminicolous hosts. Canada, Europe, Japan and U.S.A.

P. lolii Dovaston, *Trans.Br.mycol.Soc.* **31:** 251, 1948 (Fig. 331).

Anamorph: *Drechslera siccans* (Drechsler) Shoem., *Can.J.Bot.* **37:** 881, 1951.

Helminthosporium siccans Drechsler, *J. agric.Res.* **24:** 682, 1923.

Pseudothecia up to 1 mm broad with a short conical beak. Asci 2-6-8 spored, 170-240 × 27-42 μm. Ascospores hyaline to pale brown, nearly always with 5 transverse septa, with 0-4 (usually 2) longitudinal septa except in the end cells, 49-67 × 16-22 μm.

Conidiophores single or in groups, straight, sometimes geniculate towards the apex, mid brown, swollen at the base, up to 400 μm long, 7-11 μm thick with large scars. Conidia straight, almost cylindrical and slightly tapering towards the apex or base, pale to mid brown, 3-11 (commonly 4-6) distoseptate, 30-170 (mostly 60-100) × 14-22 (mostly 16-18) μm with a dark hilum.

On leaves of *Lolium* and other grasses causing dark brown, elongated spots which coalesce to form brown blotches. Australia, Europe and N. America. It is generally believed that the perfect state of *D. siccans* is *P.*

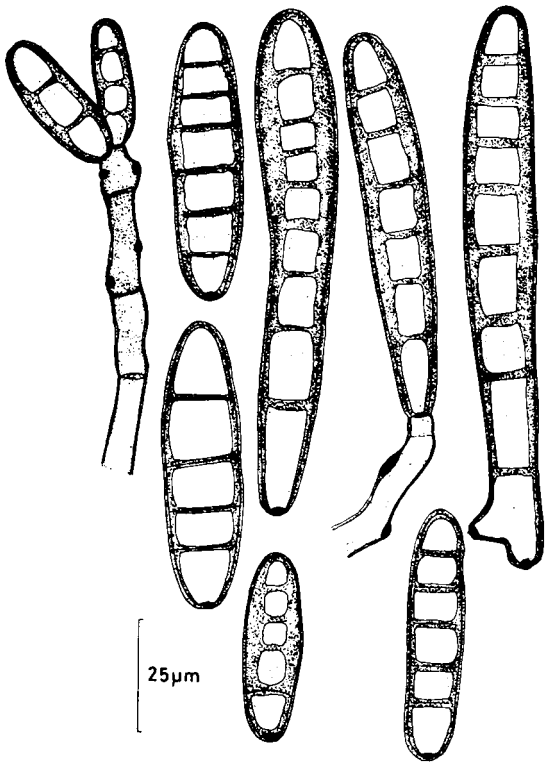


Fig. 331. *Pyrenophora lolii.* Conidiophores and conidia.

lolii but in the absence of a definitive statement to that effect by Dovaston it cannot be presumed.

P. phaeocomes (Rebent.) Fr., *Summa veg. Scand.:* 398, 1849 (Fig. 332).

Sphaeria phaeocomes Rebent., *Prodromus Fl. Neomarchi-cae Berolini:* 1-406, 1804.
Sphaeria phaeocomes Rebent.: Fr., Syst. mycol. **2:** 515, 1823.
Sphaeria capillata Nees, Syst. Pilze: 311, 1817.
Cryptosphaeria capillata (Nees) Grev., *Scot. Crypt. Fl.* **2:** 69, 1824.
Chaetomium strigosum Wallr., *Fl. Crypt. Germ.* **2:** 265, 1833.
Ceuthospora phaeocomes Rabenh., *Dt. Krypt.-Fl.* **1:** 144, 1844.
Pleospora phaeocomes (Rebent.) Winter in Rabenh., *Krypt.-Fl.* **1:** 521, 1885.

Anamorph: *Drechslera* sp.

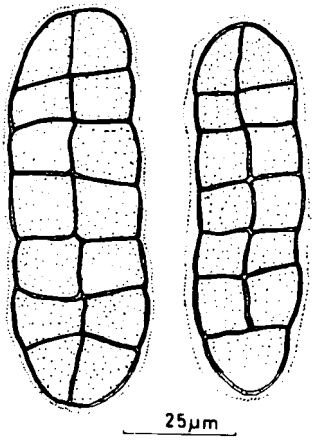


Fig. 332. *Pyrenophora phaeocomes.* Ascospores.

Pseudothecia partially erumpent from the leaves, dark brown to black, spherical, hard and sclerotioid when young, setose. Asci 8 spored, 200-250 × 80-105 µm. Ascospores oblong cylindric, transversely 3-8 septate, commonly 6 septate, with a longitudinal septum in all the cells or rarely not present in one or both of the end cells, hyaline to mid brown, enclosed in a mucilaginous sheath, 82-105 × 33-39 µm.

Only one conidium was observed by Shoemaker (1961) directly below the setae of a pseudothecium. Conidial state has been reported by Fuckel (1870) and Graham (1955). Conidia yellowish brown, except for the paler basal cell which has a dark scar, subcylindrical, tapering at the apex which is broadly hemi-elliptical, 4 distoseptate, 66 × 18 µm.

On *Anthoxanthum, Calamogrostis, Dactylis, Holcus,* Europe and U.S.A.

P. semeniperda (Brittlebank & Adam) Shoem., *Can.J.Bot.* **44:** 1451, 1966 (Fig. 333).

Pleosphaeria semeniperda Brittlebank & Adam, *Trans.Br.mycol.Soc.* **10:** 123, 1924.
Pyrenophora horrida H. Sydow, *Annls mycol.* **22:** 424, 1924.

Anamorph: *Drechslera verticillata* (O'Gara) Shoem., *Can.J.Bot.* **44:** 1451, 1966.

Podosporiella verticillata O'Gara, *Phytopathology* **5:** 324, 1915.
Bipolaris cyclops (Drechsler) Sprague, *Mycologia* **54:** 58, 1962.

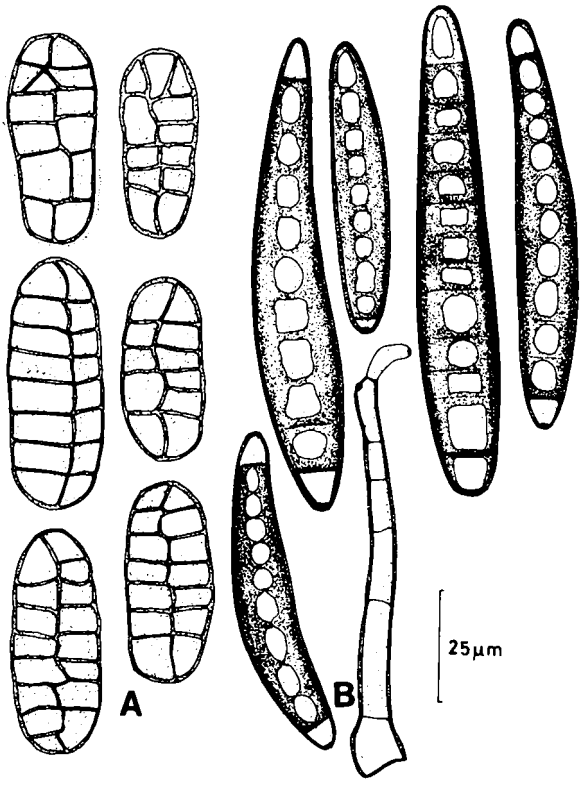


Fig. 333. *Pyrenophora semeniperda* (type). A, ascospores; B, conidiophore and conidia.

Helminthosporium cyclops Drechsler, *J.agric.Res.* **24:** 729, 1923.

Pseudothecia up to 1200 µm broad. Asci 4-8 spored, 450-675 × 35-48 µm. Ascospores monostichous, oblong with broadly rounded ends, yellow brown, slightly constricted at the septa, 5-8 transversely septate with two vertical septa laid at right angles, with a mucilaginous sheath when young, 45-88 × 18-39 µm.

Stromata erect, simple or branched, cylindrical, dark brown to black. Conidiophores straight or flexuous, sometimes geniculate, simple, mid to dark brown, usually swollen at the apex, up to 180 µm long. Conidia straight or slightly curved, cylindrical to obclavate, 7-12 distoseptate, usually with a dark septa cutting off the cell at the base and sometimes at the apex, golden brown except for colourless or pale areas immediately above the dark scar at the base and at the apex, 70-160 × 13-17 µm with a dark, black hilum.

Pycnidia were described by Bittlebank & Adam (1924). Pycnidial stage was not found in natural infections but developed in inoculated wheat grains. Pycnospores irregularly fusoid, hyaline or light brown in mass, 8-12 × 2 μm.

Paul (1969) observed structures similar in external morphology to the pycnidia described by Brittlebank & Adam (1924) but these fruit bodies remained sterile. However flask shaped spermogonia (Paul, 1969) developed in culture and these produced masses of tiny spherical hyaline spermatia about 3 μm in diam. which were exuded through the ostiole but failed to germinate. Shoemaker (1966) has given an account of both the ascus and conidial states with illustrations.

On oats, wheat and other grasses. Australia, S.Africa and U.S.A.

P. teres Drechsler, *J. agric. Res.* **24:** 656, 1923 (Fig. 334).

Anamorph: *Drechslera teres* (Sacc.) Shoem., *Can. J. Bot.* **37:** 881, 1959.

Helminthosporium teres Sacc., *Michelia* **2:** 558, 1882.
Helminthosporium hordei Eidam, *Landwirt, Breslau* **27:** 509, 1891.

Pseudothecia setose, up to 800 μm broad and 450 μm high, flat-hemispherical at first, later developing a conical or cylindrical beak. Asci 2-8 spored, 175-240 × 32-40 μm. Ascospores hyaline to pale yellow, 3-4 transversely septate (commonly 3), and without or with 1-2 longitudinal septa in the central cells, rarely a longitudinal septum, is laid in one of the end cells, constricted at the septa, 36-65 × 14-28 μm, surrounded by a mucilaginous sheath.

Conidiophores single or in groups of 2-3, swollen at the base, straight to flexuous, sometimes geniculate, mid brown except at the paler brown apex, up to 220 μm long, 7-11 μm thick. Conidia straight, cylindrical, ends broadly rounded, subhyaline to yellowish brown, 3-9 (commonly 4-6) distoseptate, sometimes slightly constricted at the septa, 70-160 (mostly 90-120) × 16-23 (mostly 19-21) μm, with a dark brown basal scar. No secondary conidiophores or conidia produced. Pycnidia superficial to partly immersed, globose to pyriform, setose near the apex. Pycnospores hyaline, spherical or ellipsoidal, one celled, 1.4-3.2 × 1-2 μm. The pseudothecial and pycnidial states have been described by Smedegard-Petersen (1972).

Causes 'net blotch' of barley and occasionally on other grasses, cosmopolitan. Brief notes on physiologic specialization, transmission and a brief description of the anamorph are given by Ellis & Waller (1973c). For taxonomy and morphology refer to Kenneth (1962).

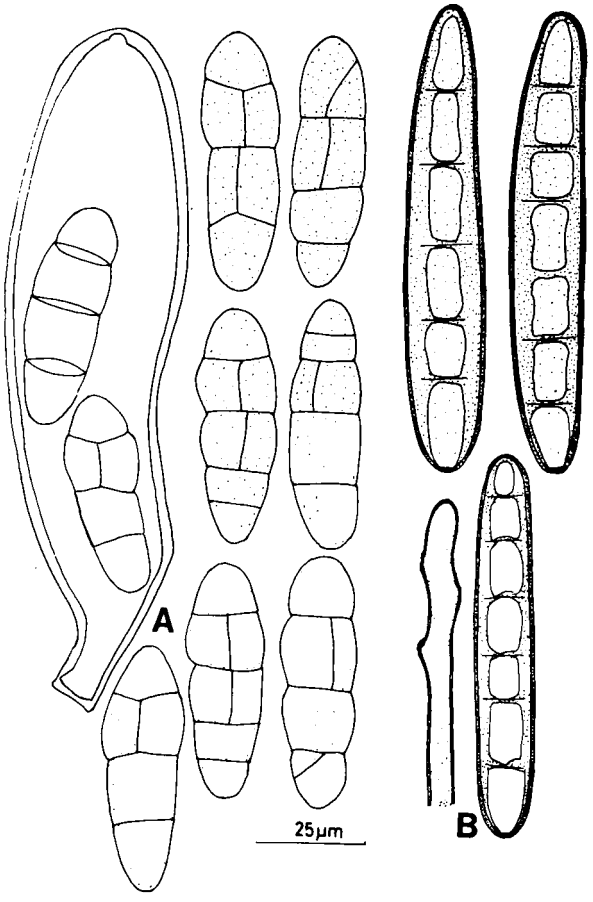


Fig. 334. *Pyrenophora teres.* A, ascus and ascospores; B, conidiophore and conidia.

P. tetrarrhenae Paul, *Trans.Br.mycol.Soc.* **56:** 261, 1971 (Fig. 335).

Anamorph: *Drechslera tetrarrhenae* Paul, *Trans.Br.mycol.Soc.* **56:** 263, 1971.

Pseudothecia ellipsoid with a short stipitate base, setose, up to 800 µm broad. Asci 4-8 spored, 170-280 × 20-32 µm. Ascospores monostichous, pale yellow brown, fusoid ellipsoid, dictyoseptate, up to 8 transverse septa with one or two longitudinal septa in the central cells, 36-55 × 15-20 µm. Mature spores constricted at the primary median septum and sometimes inconsistently verrucose. Sclerotia formed in culture.

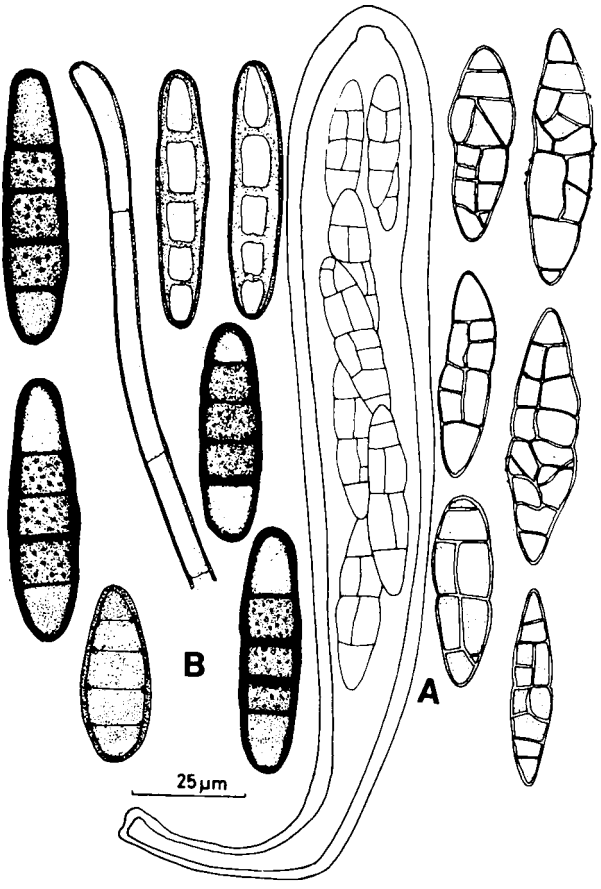


Fig. 335. *Pyrenophora tetrarrhenae* (type). A, ascus and ascospores; B, conidiophore and conidia.

Conidiophores single or in groups of 2-3 simple, erect, occasionally branched, swollen at the base, brown, paler towards the apex, septate, geniculate up to 1000 µm long. Conidia subcylindric, pale yellow brown to dark brown with tiny black dots at the junction of the septa, 3-6 (commonly 4-5) distoseptate, end cells usually lighter in colour than the central cells, 30-72 × 9-16 µm with a prominent dark hilum.

On living leaves of *Microlaena* and *Tetrarrhena* causing elongated dark brown or purple lesions. Australia.

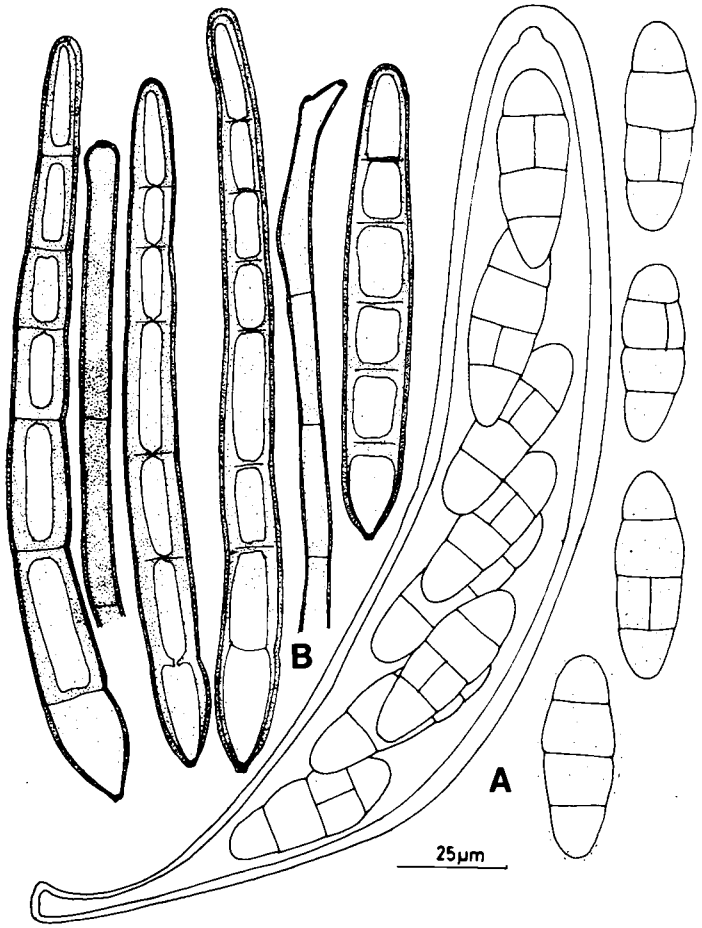


Fig. 336. *Pyrenophora tritici-repentis.* A, ascus and ascospores; B, conidiophores and conidia.

P. tritici-repentis (Died.) Drechsler, *J. agric. Res.* **24:** 667, 1923 (Fig. 336).

Pleospora tritici-repentis Died., *Zentbl. Bakt. ParasitKde.* Abt. 2, **11:** 56, 1903.
Pleospora trichostoma (Fr.) Ces. & de Not.f. sp. *tritici-repentis* (Died.) Noack, *Zeitschr. Pflanzenkrankh.* **15:** 193, 1905.
Pyrenophora tritici-vulgaris Dickson, *Diseases of Field Crops* ed. 2 McGraw Hill New York: 247, 1956.

Anamorph: *Drechslera tritici-repentis* (Died.) Shoem., *Can.J.Bot.* **37:** 880, 1959.

Helminthosporium tritici-repentis (Died.) Died., *Zentbl. Bakt. ParasitKde, Abt.* 2, **11:** 56, 1903.
Helminthosporium tritici-vulgaris Nisikado, *Ann. Phytopath.Soc.Japan* **2:** 96, 1928.
Drechslera tritici-vulgaris (Nisikado) Ito, *Proc.imp.Acad.Japan* **6:** 355, 1930.
Helminthosporium gramineum Rabenh. ex Schlecht. f. sp. *tritici-repentis* Died., *Zentbl. Bakt. ParasitKde Abt. 2,* **9:** 329, 1902.

Pseudothecia setose, up to 500 μm broad with a short beak. Asci 8 spored, 180-290 × 24-60 μm. Ascospores hyaline to yellowish brown, ends rounded, transversely 3 septate, without or with 1 longitudinal septum in one or rarely both the central cells, surrounded by a mucilaginous sheath, 42-69 (commonly 42-55) × 14-29 (14-22) μm.

Conidiophores single or in groups of 2-3, pale yellow brown, simple erect, straight or flexuous, sometimes geniculate, often with a swollen base, cylindrical or somewhat tapering towards the apex, up to 400 μm long, 6-12 μm thick, with one or few inconspicuous scars. Conidia single, straight or slightly bent, cylindrical, rounded at the ends, basal segment conical subhyaline or yellowish brown, 1-9 (commonly 5-7) distoseptate, old conidia often constricted at the distosepta, 75-250 × 14-20 μm, commonly 70-120 × 14-17 μm.

Causes severe leaf wilt and spotting especially in durum wheat. Common and widespread on *Agropyron repens* and other grasses. For a brief description of the anamorph and the disease caused by this species refer to Ellis & Waller (1976b).

RHYTIDIELLA Zalasky, *Can. J. Bot.* **46:** 1383, 1968.

Type sp.: *R. moriformis* Zalasky, *Can. J. Bot.* **46:** 1383, 1968.

Only two species known and both have been connected to two different anamorphs.

Ascocarps immersed in the bark or corky periderm, finally erumpent, black, turbinate, globose, clavate or pulvinate, usually with a truncate base, with a radially sulcate ostiole which collapses at the apex or with a pointed apex. The wall is composed of thick-walled, dark brown, pseudoparenchymatous cells which become more or less thin-walled towards the interior. Asci cylindrical or clavate, 8 spored, short stalked. Ascospores hyaline, olivaceous to yellow brown, guttulate when young, transversely multiseptate, straight, curved or sigmoid, filiform, with rounded to tapering ends. Pseudoparaphyses filiform, abundant.

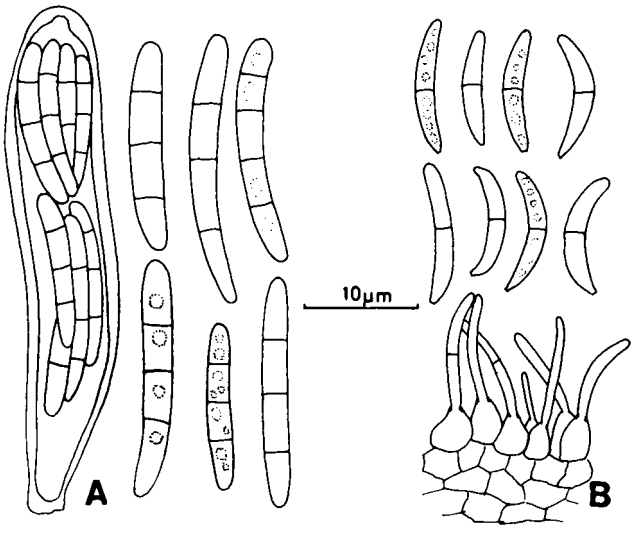


Fig. 337. *Rhytidiella baranyayi* (type). A, ascus and ascospores; B, conidiogenous cells and conidia.

Key to Rhytidiella species

Ascospores up to 15 septate, conidia *Phaeoseptoria* type..... *R. moriformis*

Ascospores up to 4 septate, conidia formed in disorganised stromata in culture only..... *R. baranyayi*

R. baranyayi Funk & Zalasky, *Can.J.Bot.* **53:** 752, 1975 (Fig. 337).

Ascocarps up to 250 µm broad. Asci 35-65 × 8-15 µm. Ascospores hyaline, straight to curved, 1-4 (mostly 3) septate, 15-25 × 2-4 µm, with rounded ends. Cultures from ascospores form dark coloured uni- to multi-locular stromatic colonies composed of light brown, smooth hyphae. On the innermost stromatic cells phialidic, enteroblastic, ampulliform conidiogenous cells are formed. Conidia hyaline, curved, 1 septate, 10-14 × 2-2.5 µm.

There is no true pycnidium formed and according to Funk & Zalasky (1975) no generic name can be applied to this conidial state. The pycnidial state resembles *Fuckelia ribesia* in the compound nature of the stroma but differs from it in the conidial shape. According to Sutton (1980) it resembles *Pseudosporella.*

This fungus causes the cork-bark disease of *Populus tremuloides* in Western Canada.

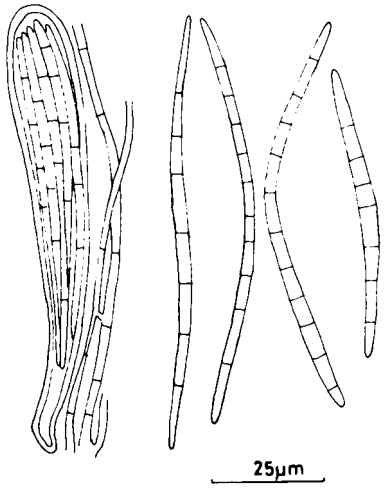


Fig. 338. *Rhytidiella moriformis* (type). Ascus and ascospores.

R. moriformis Zalasky, *Can. J. Bot.* **46:** 1383, 1968 (Fig. 338).

Anamorph: *Phaeoseptoria* sp.

Ascocarps up to 600 µm broad. Asci 80-120 × 12-18 µm. Ascospores hyaline to olivaceous, yellow brown, sinuous, sigmoid to curved, gradually tapering towards the rounded ends, 6-15 septate, 60-100 × 3-6 µm.

Phaeoseptoria pycnidia scattered, immersed, erumpent, conical to flat pulvinate, ostiolate, up to 250 µm broad. Conidiogenous cells phialidic, enteroblastic, simple or branched, 0-1 septate, hyaline, obclavate or cylindrical, 6-18 × 2-4 µm. Conidia hyaline to olivaceous, straight or curved, gradually tapering towards the rounded ends, sometimes wider below, 0-10 septate, 45-116 × 2.5-6 µm. Microconidia hyaline to pale olivaceous, ovoid, guttulate, 2-5 × 1.5-2 µm. Pycnidia formed in culture as well as occur in nature.

Causes the perennial rough-bark disease of *Populus balsamifera.* Canada.

SETOSPHAERIA Leonard & Suggs, *Mycologia* **66:** 294, 1974.

Type sp.: *S. turcica* (Luttrell) Leonard & Suggs, *Mycologia* **66:** 295, 1974.

Anamorph: *Drechslera* Ito (= *Exserohilum* Leonard & Suggs, *Mycologia* **66:** 289, 1974, = *Luttrellia* Chochryakov & Gornostaĭ (as '*Lutrellia*') apud Gonostai in Azbukina et al. (Eds.), *Algae, Fungi and Mosses of the Soviet Far East:* 81, 1978 non *Luttrellia* Shearer, 1978).

Pseudothecia superficial, immersed or erumpent, globose to ellipsoid, unilocular, dark brown to black, with or without a neck, with simple, short rigid, brown setae surrounding the ostiolar region and the upper part of the pseudothecium. The pseudothecial wall is coriaceous, carbonaceous composed of angular to globose pseudoparenchymatous cells. Asci cylindrical, clavate or cylindric-clavate, stalked, straight or curved, thick-walled, 1-8 spored. Ascospores 2-6 or rarely more septate, hyaline, fusoid to oblong, smooth, constricted at the septa, surrounded by a mucilaginous sheath which may project well beyond the ends of the ascospores. Pseudoparaphyses septate, filiform, hyaline, branched.

Seven species are known in the genus and they are all heterothallic except *S. khartoumensis*. The pseudothecial state in heterothallic species is obtained in culture by pairing opposite mating strains of the respective anamorph and it has not been found to occur on natural substrata.

Key to Setosphaeria species with anamorph

Conidia with thick dark septa at one or both ends..... 1

Conidia without thick dark septa..... 3

1. Conidia not more than 20 μm wide at the broadest part..... *S. prolata*

   Conidia often more than 20 μm wide..... 2

2. Conidia 60-130 μm long..... *S. holmii*

   Conidia 55-160 μm long..... *S. khartoumensis*

   Conidia 30-190 μm long..... *S. rostrata*

3. Conidia with a long pedicellate extension at the base..... *S. pedicellata*

   Conidia without a long pedicellate extension at the base..... 4

4. Conidia 18-33 μm wide at the broadest part..... *S. turcica*

   Conidia 15-25 μm wide at the broadest part..... *S. monoceras*

S. holmii (Luttr.) Leonard & Suggs, *Mycologia* **66:** 295, 1974 (Fig. 339).

Trichometasphaeria holmii Luttr., *Phytopathology* **53:** 285, 1963.
Keissleriella holmii (Luttr.) von Arx, *The genera of fungi sporulating in pure culture:* 126, 1970.

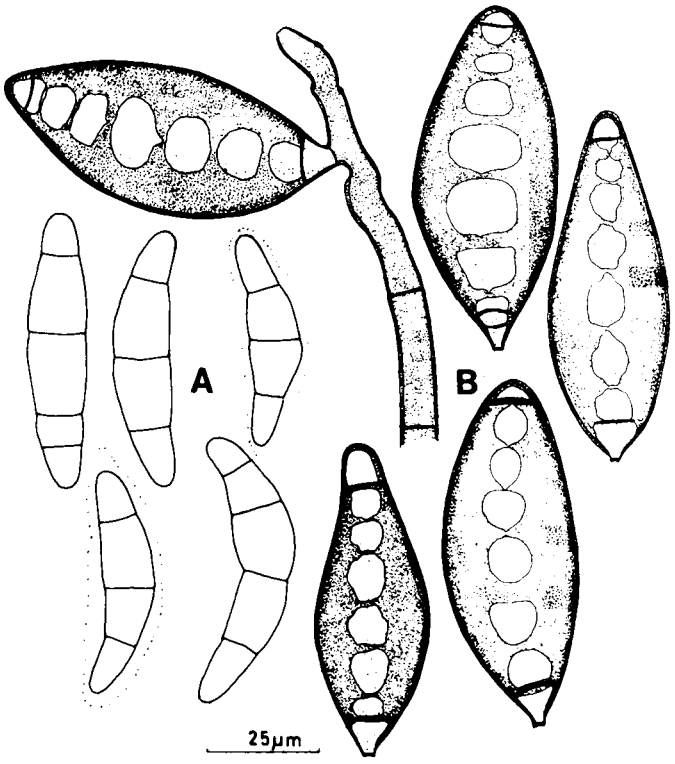


Fig. 339. *Setosphaeria holmii* (type). A, ascospores; B, conidiophore and conidia.

Anamorph: *Drechslera holmii* (Luttr.) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium holmii Luttr., *Phytopathology* **53:** 285, 1963.
Exserohilum holmii (Luttr.) Leonard & Suggs, *Mycologia* **66:** 291, 1974.

Pseudothecia up to 650 µm broad with a short ostiole. Asci clavate, 1-8 spored, 170-232 × 28-36 µm. Ascospores straight or curved, 3 septate, rarely 2-6 septate, 47-80 × 12-20 µm, often surrounded by a mucilaginous sheath.

Conidiophores up to 280 µm long, 6-10 µm wide, sometimes with a basal swelling. Conidia obclavate and rostrate or broadly ellipsoidal, straight or curved, 6-11 distoseptate, end cells often paler than the golden brown central cells and cut off by a dark thick septum, 60-130 × 20-31 µm, with a dark protuberant hilum.

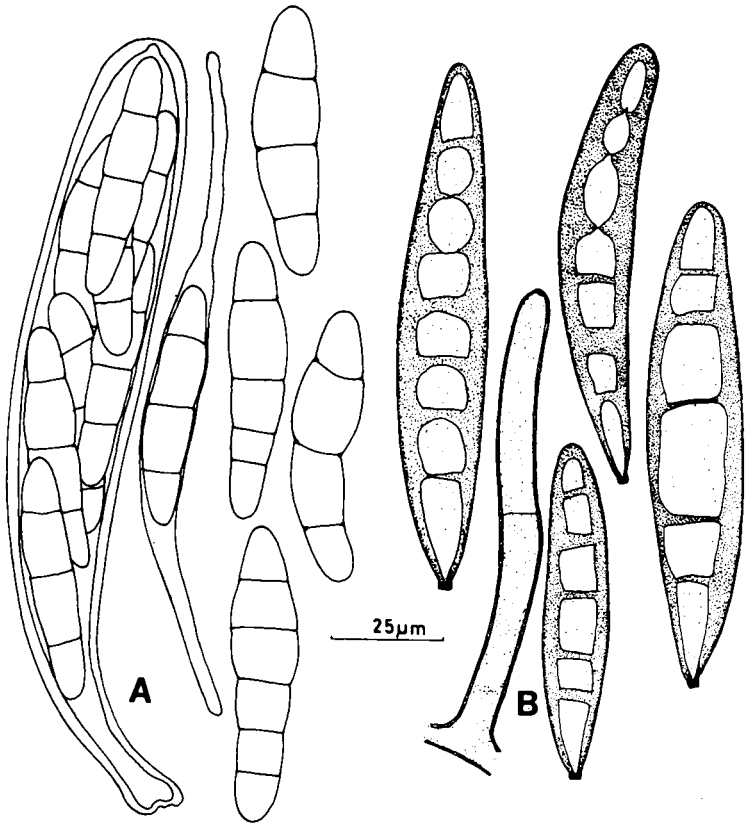


Fig. 340. *Setosphaeria monoceras* (type). A, ascus and ascospores; B, conidiophore and conidia.

On leaves of *Dactyloctenium,* barely (U.S.A); wheat roots (Nigeria) and also isolated from a variety of other substrata (Egypt, India, Kenya, Nigeria, U.S.A).

Luttrell (1963) has demonstrated the genetic connection between the ascus and the conidial state of this species.

S. monoceras Alcorn, *Mycotaxon* **7:** 411, 1978 (Fig. 340).

Anamorph: *Drechslera monoceras* (Drechsler) Subram. & Jain, *Curr.Sci.* **35:** 354, 1966.

Helminthosporium monoceras Drechsler, *J. agric.Res.* **24:** 706, 1923.

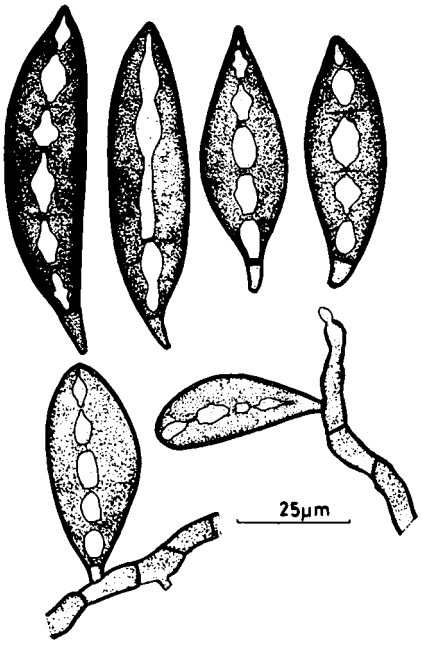


Fig. 341. *Setosphaeria pedicellata*. Conidiophores and conidia.

Bipolaris monoceras (Drechsler) Shoem., *Can.J.Bot.* **37**: 883, 1959.
Exserohilum monoceras (Drechsler) Leonard & Suggs, *Mycologia* **66**: 291, 1974.
Luttrellia monoceras (Drechsler) Chochryakov (as '*Lutrellia*') apud Gornostai in Azbukina et al. (Eds.), *Vodorosli, Gribȳ i Mkhi Dal'nego Vostoka* (Vladivostock): 81, 1978.

Pseudothecia up to 400 µm broad with a short broad beak. Asci cylindrical to clavate, 1-8 (commonly 8) spored, 135-245 × 21-35 µm. Ascospores fusoid to oblong, mostly slightly curved, 3-5 (usually 3) septate, end cells rounded, 45-75 × 11-20 µm, with a mucilaginous sheath extending as tapered cylindrical appendage from each end and measuring 50-120 × 15-25 µm.

Conidiophores up to 250 µm long. Conidia pale to olivaceous brown, fusoid, straight or curved, 3-5 distoseptate, 60-135 × 15-25 µm, truncate at the base with a small protruding hilum.

On leaves of *Echinochloa,* Australia, Cuba, Israel and U.S.A.

S. pedicellata (Nelson) Leonard & Suggs, *Mycologia* **66**: 295, 1974 (Fig. 341).

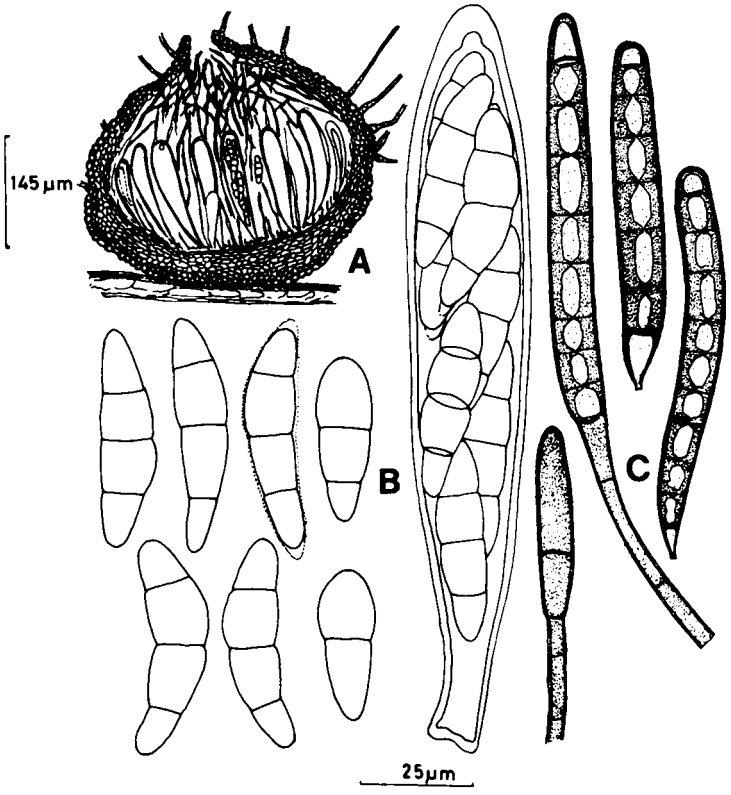


Fig. 342. *Setosphaeria prolata* (type). A, v.s. pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

Trichometasphaeria pedicellata Nelson, *Mycologia* **57:** 665, 1965.

Anamorph: *Drechslera pedicellata* (Henry) Subram. & Jain, *Curr. Sci.* **35:** 354, 1966.

Helminthosporium pedicellatum Henry, *Univ.Minn.Agric.Exp.Stn.tech.Bull.* **22:** 42, 1924.
Exserohilum pedicellatum (Henry) Leonard & Suggs, *Mycologia* **66:** 291, 1974.

Pseudothecia up to 600 µm broad. Asci cylindrical to cylindric-clavate, 1-8 spored, 125-210 × 21-32 µm. Ascospores 2-6 (usually 3) septate, 40-65 × 11-18 µm, surrounded by a thin mucilaginous sheath.

Conidiophores up to 200 µm long, 5-9 µm wide. Conidia broadly fusoid, straight, smooth, 4-9 distoseptate, golden brown, 40-90 × *16-28* µm, with a protuberant hilum and a narrow pedicel-like extension at the base.

Isolated from wheat roots (U.S.A); rice (India); maize (India, Egypt and Paktistan).

Nelson (1965) has established the connection between the ascus and the conidial state of this species.

S. prolata Leonard & Suggs, *Mycologia* **66:** 294, 1974 (Fig. 342).

Anamorph: *Drechslera prolata* (Leonard & Suggs) comb.nov.

Exserohilum prolatum Leonard & Suggs, *Mycologia* **66:** 290, 1974.

Pseudothecia up to 400 μm broad. Asci cylindrical to cylindric-clavate, mostly 8 spored, rarely 2-7 spored, 150-220 × 24-36 μm. Ascospores 2-5 (usually 3) septate, 38-72 × 11-19 μm, surrounded by a mucilaginous sheath.

Conidiophores up to 450 μm long. Conidia cylindrical, straight to slightly curved, olivaceous brown, 5-12 distoseptate, with a more thicker septum separating the end cells, 50-180 × 9-13 μm, with a protuberant hilum.

Isolated from seeds of barley (U.S.A); seeds and leaves of maize (Guatemala and U.S.A); and *Musa sapientum* (Nigeria).

S. rostrata Leonard, *Mycologia* **68:** 409, 1976 (Fig. 343).

Anamorph: *Drechslera rostrata* (Drechsler) Richardson & Fraser, *Trans.Br.mycol.Soc.* **51:** 148, 1968.

Helminthosporium rostratum Drechsler, *J.agric.Res.* **24:** 724, 1923.
Helminthosporium halodes Drechsler, *J.agric.Res.* **24:** 709, 1923.
Helminthosporium halodes Drechsler var. *tritici* Mitra, *Trans.Br.mycol.Soc.* **15:** 287, 1931.
Helminthosporium halodes Drechsler var. *elaedicola* Kovachich, *Trans.Br. mycol.Soc.* **37:** 423, 1954 (as '*elaeicola*').
Bipolaris rostrata (Drechsler) Shoem., *Can.J.Bot.* **37:** 883, 1959.
Bipolaris halodes (Drechsler) Shoem., *Can.J.Bot.* **37:** 883, 1959.
Drechslera halodes (Drechsler) Subram. & Jain, *Curr.Sci.* **35:** 354, 1966.
Exserohilum rostratum (Drechsler) Leonard & Suggs, *Mycologia* **66:** 290, 1974.
Exserohilum halodes (Drechsler) Leonard & Suggs, *Mycologia* **66:** 290, 1974.
Luttrellia rostrata (Drechsler) Gonorstai (as *Lutrellia*') in Azbukina *et al.* (Eds.) *Vodorosli, Griby Mkhi Dal'nego Vostoka* (Vladivostock): 81, 1978.

Pseudothecia up to 500 μm broad. Asci cylindric-clavate, 1-8 spored, 105-260 × 26-42 μm. Ascospores 3-5 (or sometimes rarely more) septate

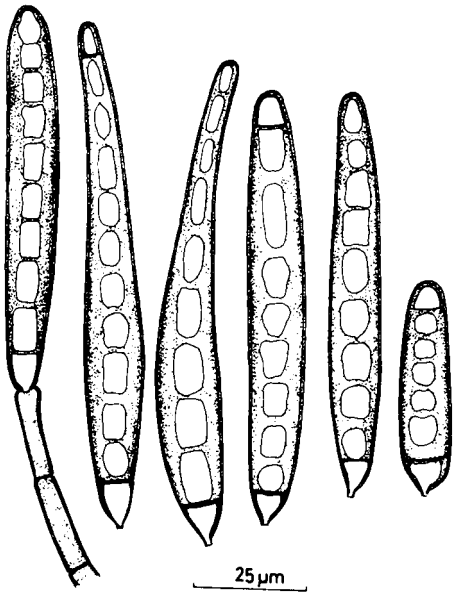


Fig. 343. *Setosphaeria rostrata* (para type). Conidiophore and conidia.

29-85 × 9-21 µm, with a thin hyaline mucilaginous sheath protruding at the ends of the spore.

Conidiophores up to 200 µm long, 5-8 µm thick. Conidia straight or slightly curved, ellipsoid to narrowly obclavate or rostrate, 6-16 distoseptate, end cells often hyaline and cut off by a thick dark septum, intermediate cells brown to olivaceous, 30-190 × 10-29 µm with a distinct protruberant hilum.

On grasses and many other substrata, isolated from soil, cosmopolitan. Anahosour & Sivanesan (1978) have briefly described and illustrated the anamorph along with a short note on the disease symptoms and control.

S. turcica (Luttr.) Leonard & Suggs, *Mycologia* **66:** 295, 1974. (Fig. 344).

Trichometasphaeria turcica Luttr., *Phytopathology* **48:** 282, 1958.
Keissleriella turcica (Luttr.) von Arx, *The genera of fungi sporulating in pure culture:* 126, 1970.

Anamorph: *Drechslera turcica* (Pass.) Subram. & Jain, *Curr. Sci.* **35:** 355, 1966.

Helminthosporium turcicum Pass., *Boll.Comizio Agr.Parma* No.10, 1876.
Helminthosporium inconspicuum Cooke & Ellis, *Grevillea* **6**: 88, 1878.
Bipolaris turcicum (Pass.) Shoem., *Can.J.Bot.* **37**: 884, 1959.
Exserohilum turcicum (Pass.) Leonard & Suggs, *Mycologia* **66**: 291, 1974.
Luttrellia turcica (Pass.) Chochryakov (as '*Lutrellia*') apud Gornostaĭ in Azbukina et al. (Eds.), *Vodorosli,Gribŷ i Mkhi Dal'nego Vostoka* (Vladivostock): 81, 1978.

Pseudothecia up to 500 μm broad. Asci cylindrical to cylindric-clavate, 1-8 spored, 175-250 × 24-31 μm. Ascospores 1-6 (commonly 3) septate, 40-78 × 12-18 μm, surrounded by a mucilaginous sheath.

Conidiophores up to 300 μm long, 8-10 μm wide. Conidia straight or slightly curved, ellipsoidal to obclavate, pale to mid straw coloured, smooth, 4-9 distoseptate, 50-144 × 18-33 μm with a distinct protuberant hilum.

Luttrell (1958) has established the connection between the ascus and conidial state of this species.

On leaves of sorghum and maize, occasionally on other grasses, cosmopolitan. (CMI Distr. Map. 257).

Recently El Shafie & Webster have described a homothallic species of *Setosphaeria, S. khartoumensis (Trans. Br. mycol. Soc.* **77**: 442-446, 1981 with an *Exserohilum* anamorph isolated from grains of *Sorghum bicolor* from Sudan.

SPLANCHNONEMA Corda in Sturms', *Deutschl.Fl.*Abt. 3, **2**: 115, 1829.

Stigmatomassaria Munk, *Dansk Bot. Ark.* **15**: 126, 1953.

Lectotype sp.: *S. foedens* (Fr.) Kuntze, *Rev.Gen.Pl.* **3**: 530, 1898.

Anamorphs: *Stegonsporium* Corda and *Myxocyclus* Riess

About twelve species known (Shoemaker & LeClair, 1975; Barr, 1982).

Pseudothecia immersed in the bark, scattered, singly or in small clusters, erumpent through the periderm by a minute apical papilla, often collapsing. Asci cylindric clavate to broadly clavate, 8 spored, thick-walled, stalked, arising on a broad basal hymenium. Ascospores clavate, asymmetrically transversely multiseptate, euseptate or distoseptate, strongly constricted at one of the septa, enveloped by a mucilaginous sheath. Pseudoparaphyses filamentous, branched, hyaline.

Splanchnonema is separated from *Massaria* by clavate, asymmetrically septate ascospores. (Shoemaker & LeClair, 1975).

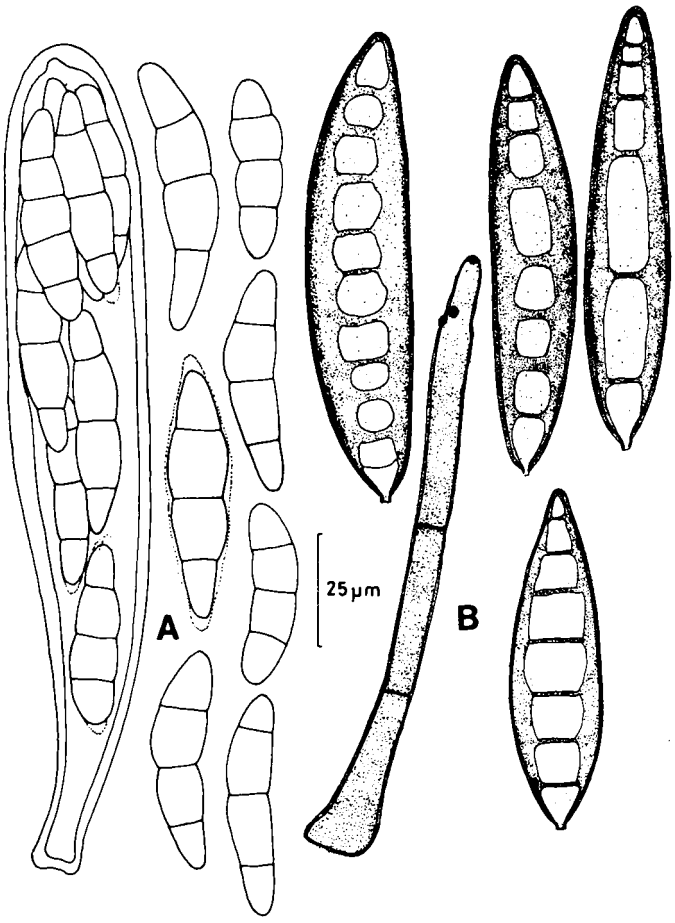


Fig. 344. *Setosphaeria turcica.* A, ascus and ascospores; B, conidiophore and conidia.

Key to Splanchnonema species with anamorphs

Ascospores 6 septate, 48-70 × 11-17 µm..... *S. argus*

Ascospores 3 septate, 38-55 × *10-18 µm*..... *S. pupula*

S. argus (Berk. & Br.) Kuntze, *Rev.Gen.Pl.* **3:** 531, 1898 (Fig. 345,346).

Sphaeria argus Berk. & Br., *Ann.Mag.Nat.Hist.ser.* 2, **9:** 322, 1852.
Massaria argus (Berk. & Br.) Fres., *Beitr. Mykol.* **2:** 59, 1852.

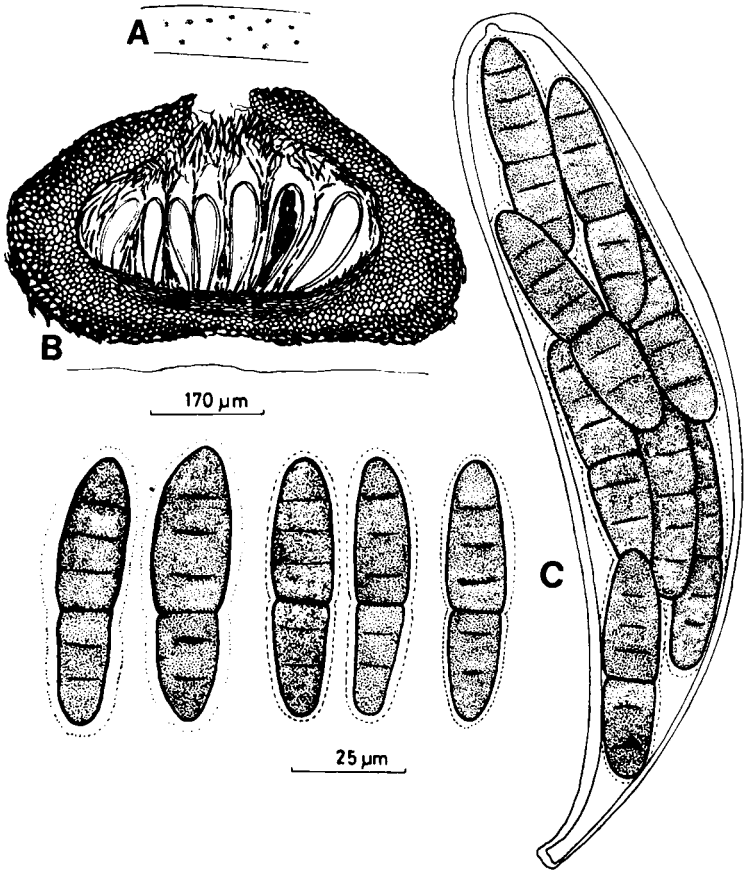


Fig. 345. *Splanchnonema argus*. A, pseudothecia (habit) on wood; B, v.s. pseudothecium; C, ascus and ascospores.

Massaria niessliana Rehm, *Hedwigia* **21:** 84, 1882.
Splanchnonema niessliana (Rehm) Kuntze, *Rev.Gen.Pl.* **3:** 531, 1898.

Anamorph: *Myxocyclus polycistis* (Berk. & Br.) Sacc., *Annls mycol.* **6:** 559, 1908.

Hendersonia polycistis Berk. & Br., *Ann.Mag.Nat.Hist. ser.* 2, **5:** 374, 1850.
Stegonsporium muricatum Bonordon, *Handb.Prakt.Heilkunde* **1:** 60, 1851.
Stegonosporium muricatum Bonordon, *Handb.Prakt.Heilkunde* **1:** 60, 1851.
Myxocyclus confluens Riess in Fres., *Beitr. Mykol.* **2:** 63, 1852.
Coryneum irregulare Berk. & M.A. Curtis in Berk., *Grevillea* **2:** 154, 1874.
Stegonsporium irregulare (Berk. & M.A. Curtis) Sacc., *Syll.Fung.* **3:** 804, 1884.
Stegonsporium irregulare Fautrey, *Rev.mycol.* **17:** 170, 1895.
Stegonsporium fautreyi Sacc. & Sydow in Sacc., *Syll. Fung.* **14:** 1035, 1899.
Stegonsporium betulae Bresad. in Noelli, *Malpighia* **17:** 417, 1903.

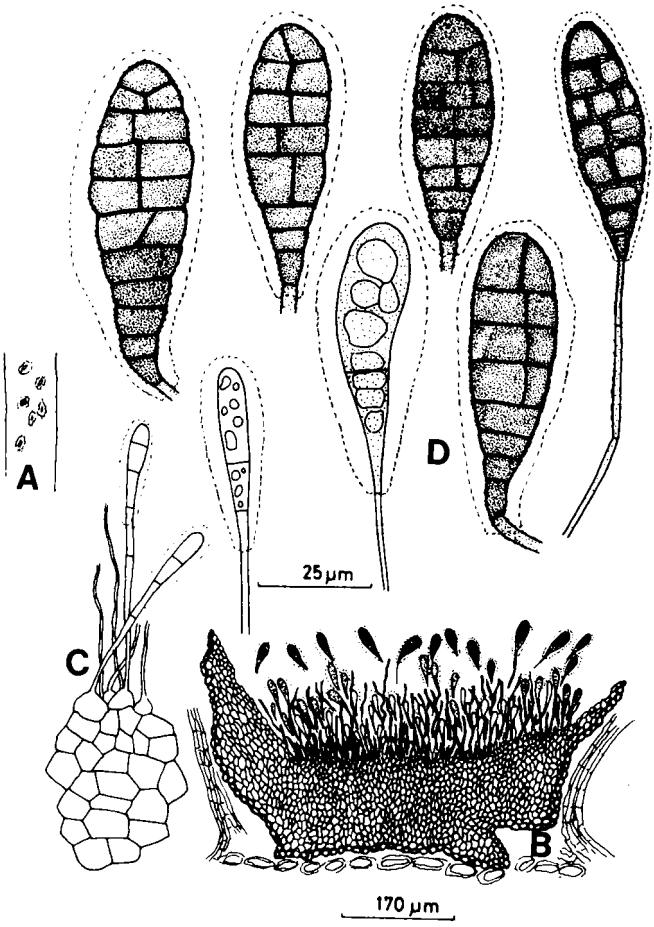


Fig. 346. *Splanchnonema argus*. A, acervuli on wood; B, v.s. acervulus; C, conidiophores; D, conidia.

Pseudothecia in small clusters beneath the periderm, erumpent through the periderm by a minute papillate ostiole, up to 1500 µm broad often collapsing. The thick leathery wall is often greyish towards the inside. Asci 250-300 × 30-35 µm. Ascospores 6 distoseptate, constricted at the fourth septum from above, 48-70 × 11-17 µm, surrounded by a mucilaginous sheath, when mature consisting of an upper four celled part and a lower three celled part.

Acervuli immersed, subepidermal, scattered, rarely confluent, dark brown to black, rupturing the periderm. The wall is composed of dark brown, thick-walled, irregular to angular cells at the base, and thin-

walled pale brown cells above in the conidiogenous region, up to 400 μm wide at the base and up to 800 μm wide at the top; the dark pseudoparenchymatic wall sometimes extends laterally to form a marginal wall of 4-5 cells thick. Conidiophores formed from the upper cells, cylindrical, flexuous, erect, very pale brown, verruculose, hyaline towards the apex, septate, branched at the base, 90-220 × 4-6 μm, enclosed in a mucilaginous sheath, which is more apparent at the apex. Conidiogenous cells holoblastic, integrated, hyaline to very pale brown, cylindrical, 9-16 × 4-6 μm. Conidia verruculose, tapered towards the base, obtuse at the apex, often with a part of the conidiophore remaining attached, dark brown, basal cells paler, 7-8 transversely distoseptate, often constricted at the septa, with several vertical or oblique distosepta, lumina reduced, 50-66 × 20-26 μm, completely enveloped in a gelatinous sheath which is up to 4 μm thick.

On dead branches of *Betula* spp. Europe and Eastern N. America.

Myxocyclus differs from *Stegonsporium* by verruculose conidia enveloped in a persistent mucilaginous sheath. The taxonomy of this genus with illustrations and descriptions has been given by Sutton (1975). Tulasne & Tulasne (1863) were the first to indicate the association of *Myxocyclus confluens* with *S. argus*.

S. pupula (Fr.) Kuntze, *Rev.Gen.Pl.* **3:** 531, 1898 (Fig. 347).

Sphaeria pupula Fr., *Vetensk. Acad. Handl. ser.* 3, **6:** 104, 1818.
Sphaeria pupula Fr.: Fr., *Syst. mycol.* **2:** 484, 1823.
Hercospora pupula (Fr.:Fr.) Fr., *Summa veg. Scand.:* 397, 1849.
Massaria pupula (Fr.:Fr.) L.R. & C. Tul., *Sel. Fung. Carp.* **2:** 225, 1863.
Stigmatomassaria pupula (Fr.: Fr.) Munk, *Dansk Bot. Ark.* **15:** 127, 1953.

Anamorph: *Stegonsporium pyriforme* (Hoffm.) Corda, *Icon Fung.* **3:** 23:1839.

Stilbospora pyriformis Hoffm., *Dt. Fl.* **II** (Krypt.), t. 13, fig. 2, 1795.
Stilbospora ovata Pers., *Usteri's Ann. Bot.* **15** Stuck: 31, 1795.
(For additional synonyms refer to Van Warmelo & Sutton, *Mycol.Pap.* **145,** 1981).

Mycelium immersed, branched, septate, hyaline to pale brown. Pseudo thecia scattered, solitary to aggregated, immersed in the bark, up to 750 μm broad, with a minute apical papilla which appear as black erumpent dots on the surface of the wood. Asci cylindric-clavate, 120-230 × 28-45 μm. Ascospores hyaline becoming dark brown, 3 septate, strongly constricted at the mid septum, minutely punctate, 38-55 × 10-18 μm, surrounded by a mucilaginous sheath.

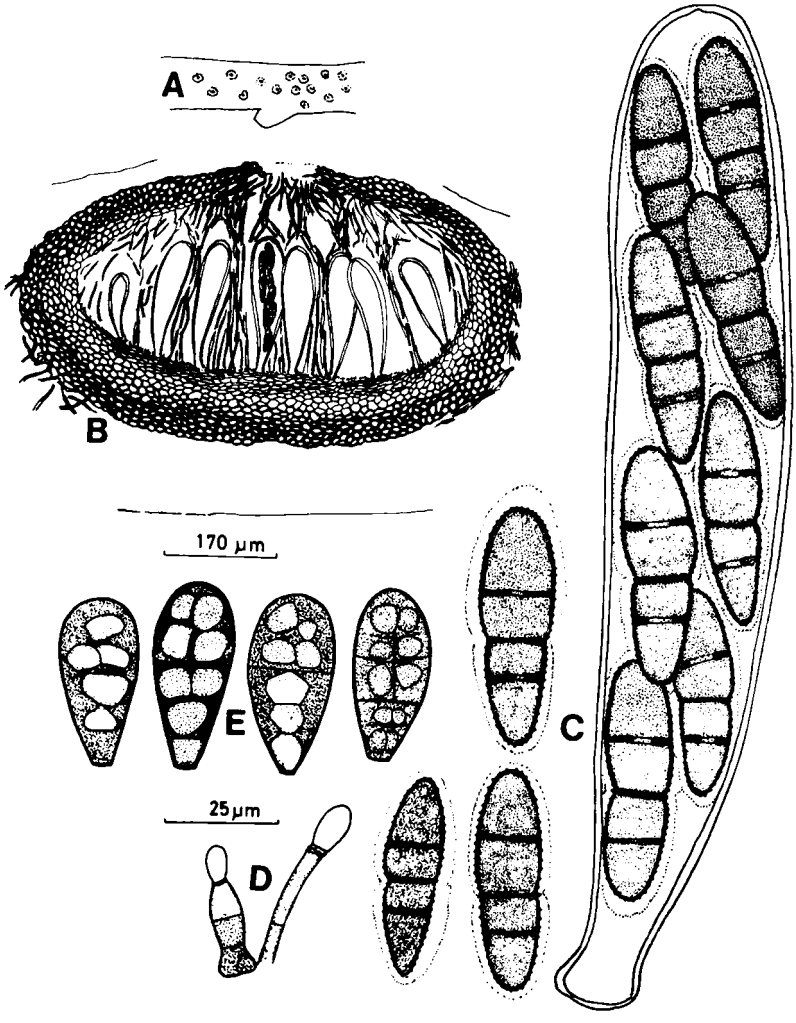


Fig. 347. *Splanchnonema pupula*. A, pseudothecia (habit) on wood; B, v.s. pseudothecium; C, ascus and ascospores; D, conidiophores; E, conidia.

Acervuli separate or confluent, rounded, dark brown to black, immersed in the bark, with a wall up to 1 mm in diam., composed of small hyaline angular cells. Conidiophores cylindrical, branched towards the base, hyaline, smooth, septate up to 40 µm long and 5-6 µm thick, formed from the upper cells. Conidiogenous cells holoblastic, annellidic, with up to three percurrent proliferations, integrated or discrete, hyaline. Conidia clavate to obovoid, brown, smooth, trans-

versely 4-5 distoseptate and with the upper cells often with vertical distosepta, cell lumen markedly reduced, 35-40 × 17-20 μm, with an obtuse apex and truncate base.

On dead branches of *Acer pseudoplatanus,* Europe and *Acer* spp., North America.

ZEUCTOMORPHA Sivan., P.M. Kirk & Govindu gen. nov.

Coloniae hypophyllae, orbiculares, punctiformes, atrobrunneae, pilosae. Mycelium superficiale ex hyphis ramosis et anastomosantibus, septatis, laevibus, brunneus, reticulatis compositum. Setae in hyphis formatae, rectae vel flexuosae, cylindrici vel subulatae, brunneae, rugulosae vel verruculosae, septatae. Pseudothecia superficialis, globosa vel leviter complanata, ostiolata, pilosa. Asci clavati vel aliquantum cylindrici, octosporae, bitunicati. Ascosporae brunneae, uniseptatae, constrictae, ellipticae, laeves, untrinque rotundatae. Pseudoparaphyses filiformes, hyalinae, septatae, ramosae.

Sp. typ.: *Z. arecae* Sivan., P.M. Kirk & Govindu

Colonies hypophyllous, orbicular, punctiform, dark brown, hairy. Mycelium superficial, composed of branched, anastomosing, septate, smooth, brown, reticulate hyphae. Setae on mycelium erect to flexuous, cylindrical to subulate, brown, rugulose to verruculose, septate. Pseudothecia superficial, globose to slightly flattened, ostiolate, hairy. Asci clavate to somewhat cylindrical, 8 spored, bitunicate. Ascospores brown, one septate, constricted at the septum, elliptical, smooth, ends rounded. Pseudoparaphyses filiform, hyaline, septate, branched.

Z. arecae Sivan., P.M. Kirk & Govindu sp. nov. (Fig. 348).

Anamorph: *Acroconidiellina arecae* (Berk. & Br.) M.B. Ellis, *Mycol. Pap.* **125:** 26, 1971.

Helminthosporium arecae Berk. & Br., *J. Linn.Soc.* **14:** *98, 1873.*
Brachysporium arecae (Berk. & Br.) Sacc., *Syll. Fung.* **4:** 429, 1886.
Exosporium pulchellum Sacc., *Nuovo G.bot. Ital.* **23:** 215, 1916.
Exosporium eximum Sacc., *Bull. Orto bot. Napoli* **6:** 64, 1918.
Exosporium arecae (Berk. & Br.) Petch, *Ann. R. bot. Gdns Peradeniya* **10:** *74,* 1927.

Coloniae hypophyllae, orbiculares, punctiformes, atrobrunneae, pilosae. Mycelium superficiale ex hyphis ramosis et anastomosantibus, septatis, laevibus, brunneae, 3-7 μm crassa, reticulatis compositum. Setae in hyphis formatae, erectae vel flexuosae, cylindrici vel subulatae, brunneae, rugulosae

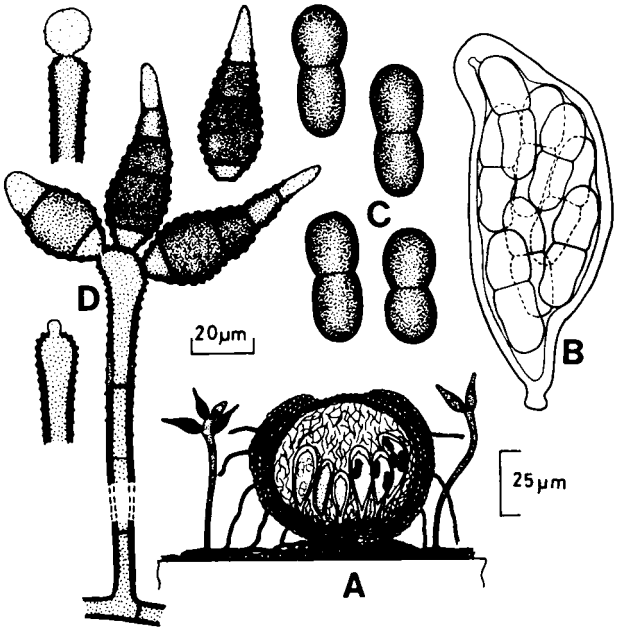


Fig. 348. *Zeuctomorpha arecae* (type). A, v.s. pseudothecium with conidiophores; B, ascus; C, ascospores; D, conidiophores and conidia.

vel verruculosae, usque 450 µm longae, 5-8 µm crassae. Pseudothecia superficialia, globosa vel breviter complanata, ostiolata, 175-300 µm diam. Paries pseudothecii pilosae, usque 25 µm crassa ex cellulis crassotunicatis, atrobrunneis, pseudoparenchymaticis. Asci clavati vel aliquantum cylindrici, crassotunicati, bitunicati, octosporae, (90) 120-140 × 35-45 (55) µm. Ascosporae brunneae, laeves, uniseptatae, constrictae, ellipticae, 28-40 (46) × 12-18 µm (23) µm. Pseudoparaphyses filiformes, hyalinae, septatae, ramosae.

In folii *Arecae catechu,* Shimogel, India, 1 November 1979, H.C. Govindu, IMI 246067 (holotypus).

Colonies hypophyllous, small, orbicular, often punctiform, numerous and close together, dark blackish brown, hairy. Mycelium almost superficial and composed of a close network of branched and anastomosing, smooth, mid to dark brown, 3-7 µm thick hyphae, but each colony is anchored to the substratum by a narrow brown hypha which grows from the stoma. Setae erect to flexuous, cylindrical to subulate, brown, rugose to verruculose, up to 450 µm long, 5-8 µm thick. Pseudothecia superficial on a subiculum, globose to slightly flattened, dark brown, when dry collapsed at the apex, ostiolate at maturity, 175-300 µm diam., hairy with superficial hyphae growing into the substrate from the base of the pseudothecium. The pseudothecial wall up to 25 µm thick is

composed of thick-walled, dark brown pseudoparenchymatous cells up to 7 μm wide. Asci few, clavate to rarely somewhat cylindrical, thick-walled, bitunicate, 8 spored, ends rounded, short stalked, (90) 120-140 × 30-45(55) μm. Ascospores brown, smooth, one septate, constricted at the septum, elliptical, 28-40(46) × 12-18(23) μm. Pseudoparaphyses filamentous, hyaline, septate, branched and anastomosing.

Conidiophores erect or suberect, straight or slightly flexuous, unbranched, mid to dark brown, rugulose or verruculose, thick-walled, septate, up to 450 μm long, but usually shorter, 5-8 μm thick. Setae erect or flexuous, cylindrical to subulate, mid to dark brown, rugulose or verruculose, thick-walled, septate, up to 700 μm long, 6-9 μm thick. Conidiogenous cells integrated, terminal, polytretic, sympodial, cicatrized. Conidia solitary, straight, obturbinate to obclavate, 3-5, usually 4 sepate, with central cells verrucose, mid to dark brown, cells at each end paler and smoother, 43-75 × 18-20 μm.

On leaves of *Areca catechu*. Burma, India, Malayasia, Papua New Guinea, Philippines, Singapore. Solomon Islands, Sri Lanka.

Tubeufiaceae Barr

Pseudothecia superficial, globose, conical, clavate, cylindrical, ellipsoidal to doliiform, with an obtuse papillate apex. Peridium soft, pseudoparenchymatous, black, or often bright to light coloured. Asci 4-8 spored. Ascospores hyaline to yellowish brown, rusty brown, narrowly to broadly obovoid, oblong, filiform or acerose, transversely multiseptate.

Parasitic on scale insects, hyperparasitic on other ascomycetes or saprobic on dead herbaceous stems or wood.

Barr (1980) has included ten genera in this family which she has treated extensively.

Anamorphs: *Dactylella*-like, *Helicoma* Corda, *Helicosporium* Nees: Fr., *Helicomyces*-like, *Tetracrium* Henn., *Tetranacrium* Hudson & B. Sutton, *Monodictys*-like, also *Asteromella*-like spermatial state.

Key to Genera of Tubeufiaceae with anamorphs

Pseudothecia black, often collapsing to cupulate..... *Thaxteriella*

Pseudothecia coloured or black when old..... 1

1. On scale insects..... *Podonectria*

   On plants or hyperparasites on other fungi..... 2

2. Ascospores filiform..... *Acrospermum*

   Ascospores elongate fusiform..... *Tubeufia*

ACROSPERMUM Tode, *Fung. Mecklen. Sel.* **1:** 8, 1790.

Type sp.: *A. compressum* Tode: Fr.

Anamorph: Belongs to Moniliales (Webster, 1956).

Ascocarps solitary or in groups, clavate or cylindrical, scattered, yellow, brown, dark brown to almost black, stalked or with a broad base and bursting through the epidermis, rounded or conate at the apex, usually flattened above, sometimes collapsing when dry. The wall is composed of usually three layers. The outer layer consists of cells of

textura prismatica or textura intricata. The inner layer is made up of several rows of thin walled, hyaline angular cells. The central layer is composed of thick walled sclerenplectenchymatous hyphae in textura intricata. Asci fasciculate, narrowly cylindrical, 8 spored, confined to the upper part of the ascocarp, separated by hyaline, filiform pseudoparaphyses. Ascospores filiform, hyaline, almost as long as the ascus.

About 42 species have been described in this genus which is heterogenous and only two are known to have anamorphs.

Acrospermum is perhaps better placed in a separate family Acropermaceae Fuckel.

Key to Acrospermum species with anamorphs

Ascocarps distinctly stalked, up to 3 mm high, on herbaceous plants..... ..... *A. compressum*

Ascocarps with a broad base, up to 1.2 mm high, on grasses..... *A. graminum*

A. compressum *Tode, Fung. Mecklen. Sel.* **1:** 8, 1790 (Fig. 349).

Ascocarps clavate, scattered, with a short narrow cylindrical stalk, dark brown to almost black, compressed above, up to 3 mm high and 400 μm wide. The wall 50-60 μm thick is composed of parallel narrow hyphae, turning outwards and expanding at their tips to form a pseudoparenchymatous outer layer of brown, polygonal cells up to 10 μm wide. The inner layers are composed of thick-walled, sclerenplectenchymatous hyphae forming a textura intricata and towards the interior the several rows of cells are small and somewhat thick-walled. Asci fasciculate, confined to the wider part of the ascocarp, narrowly cylindrical, up to 500 μm long, 3-4 μm wide, 8 spored, separated by numerous, filiform, hyaline pseudoparaphyses. Ascospores filiform, almost as long as the ascus, about 0.5 μm wide.

Webster (1956) cultured *A. compressum* by transferring ascospores and asci to maize extract agar medium and produced submerged and aerial mycelia with upright, long conidiophores. Conidiophores mostly unbranched, rarely geniculate, hyaline to very pale olivaceous, paler towards the apex, 20-80 μm × 3-4 μm, tapering to a 2 μm thick apex. The apex of the conidiophore (conidiogenous cell) bears a radiate group of conidia. Conidiogenous cells polyblastic, cylindrical, cicatrized with indistinct scars. Conidia pale yellow in mass, cylindrical to clavate, tapering to a flattened dark scar below, rounded above, 1-3 (usually 1) septate, constricted at the septum, 8-30 × 2.5-4 μm.

On dead herbaceous stems, especially on *Urtica, Europe.*

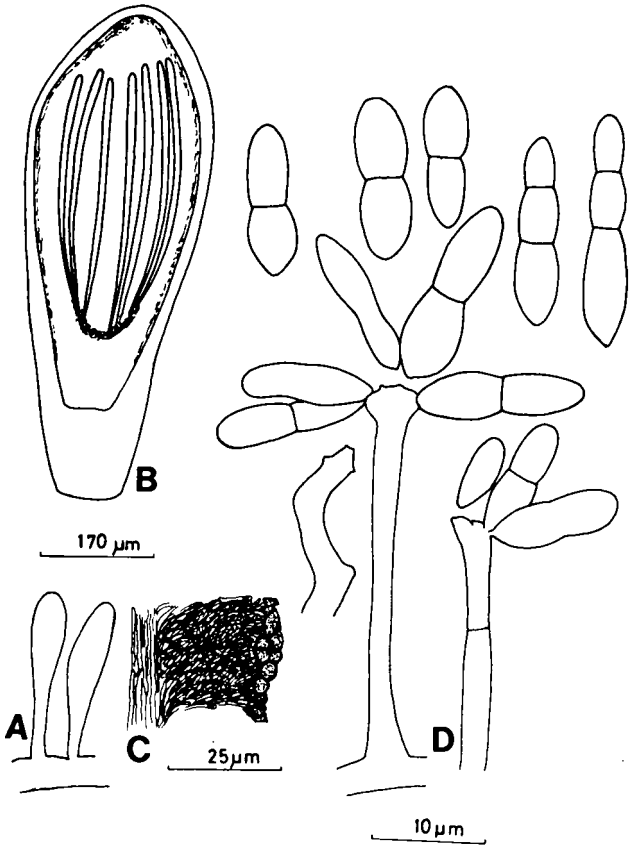


Fig. 349. *Acrospermum compressum.* A, pseudothecia; B, v.s. pseudothecium; C, wall structure; D, conidiophores and conidia.

A. graminum *Lib., Fl. Crypt. Ard.* **1:** 33, 1830 (Fig. 350).

Ascocarps clavate, solitary or in groups, yellow to brown, with a broad base and bursting through the epidermis, slightly compressed above, rounded to conate at the apex, collapsing when dry, up to 1.2 mm high and 200-300 µm broad. The wall is composed of three layers. The outer layer consists of one or two rows of brown cells, the central layer of several rows of thick-walled, sclerenplectenchymatic hyaline hyphae in textura intricata and the innermost layer of several rows of thin-walled, hyaline, angular cells. Asci fasciculate, narrowly cylindrical, tapering at the base, rounded above, 8 spored, 400-600 × 4-6 µm, separated by filiform, hyaline, pseudoparaphyses. Ascospores filiform, about as long as the ascus, about 0.5 µm wide.

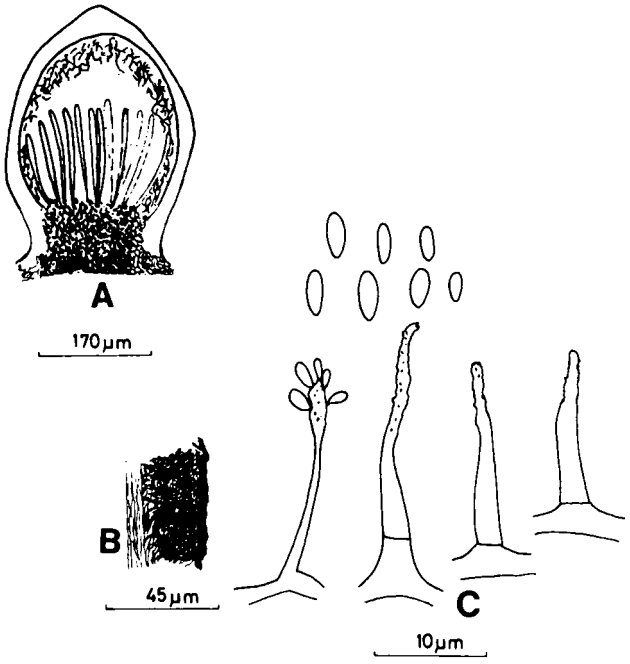


Fig. 350. *Acrospermum graminum*. A, v.s. pseudothecium; B, wall structure; C, conidiophores and conidia.

The conidial state was obtained in culture by Webster (1956) from ascospores and asci transferred to an agar medium. Conidiophores unbranched, sometimes septate near the base, 15-16 × 2-4 µm. Conidiogenous cells hyaline, denticulate, polyblastic. The first formed conidium is produced terminally as a cylindrical swelling at the tip of the conidiophore and is displaced laterally by the formation of a second growing point which grows beyond the first formed conidium and produces the second conidium. This process is repeated so that an 'ear' of conidia is formed. Conidia hyaline, cylindrical or elliptical, one celled, 3-6 × 1.5-2.5 µm. Similar conidia and conidiophores have also been found developing from the wall of the fruit body after incubation in a damp chamber (Eriksson, 1967b).

A variety of *A. graminum*, *A. graminum* var. *decipiens* (Pass.) Erikss. has been described by Eriksson (1967b) and this differs from *A. graminum* in the wall structure and in the much narrower and more cylindrical ascocarp.

On graminicolous hosts, Europe.

The anamorph of *A. compressum* differs from *A. graminum* in the septate conidia and in the method of formation of conidia.

PODONECTRIA Petch, *Trans. Br. Mycol. Soc.* **7:** 146, 1921.

Lectotype sp.: *P. coccicola* (Ell. & Ev.) Petch (designated by Clem. & Shear (1931) as '*P. coccophila*'), *Trans.Br.mycol.Soc.* **7:** 146, 1921.

Anamorphs: *Tetracrium* Henn. and *Tetranacrium* Hudson & B. Sutton (associated)

Pseudothecia superficial in or on a stroma, fleshy, white, reddish, yellow to brown, smooth, scurfy with hairs or inside a stroma, ostiolate. Hairs formed as extensions of the outer cells of the wall. The wall of textura angularis or prismatica is composed of polygonal cells with the cells on the outer layers larger, more thick-walled and sometimes pigmented. Asci elongate clavate to cylindrical, 8 spored. Ascospores parallel inside the ascus, cylindric to elongate clavate, hyaline, multiseptate, smooth to faintly verruculose. Pseudoparaphyses numerous, reticulately branched, filiform.

Associated *Tetracrium* and the closely related *Tetranacrium* anamorphs produce holoblastic hyaline staurospores inside a sporodochium or a pycnidium respectively.

About eight species known (Rossman, 1978) occurring on scale insects.

Key to Podonectria species with anamorphs

Pseudothecia brightly coloured, fleshy, smooth or hairy, anamorph *Tetracrium*. 1

Pseudothecia brown to dark brown, anamorph *Tetranacrium*..... *P. gahnia*

1. Pseudothecia smooth, rarely with few thick walled hairs around the ostiolar region..... *P. coccicola*

   Pseudothecia with hyaline flexuous hairs or with deltoid fascicle of hairs.. 2

2. Pseudothecia with deltoid fascicle of hairs..... *P. echinata*

   Pseudothecia with flexuous hyphae not fasciculate..... *P. aurantii*

P. aurantii (Höhnel) Petch, *Trans.Br.mycol.Soc.* **7:** 149, 1921.

Puttemansia aurantii Höhnel, *Sber.Akad.Wiss.Wien* **120:** 408, 1911.
Ophionectria tetraspora Miyabe & Saw., *J.Coll.Agric.Tohoku Imp.Univ.* **5:** 85, 1913.

Ophionectria aurantii (Höhnel) Petch, *Trans.Br.mycol.Soc.* **7:** 151, 1921.

Anamorph: *Tetracrium aurantii* Henn., *Hedwigia* **41:** 116, 1902.

Pseudothecia solitary to aggregated on a white byssoid stroma, pale yellow to brown, covered with flexuous hyaline hyphae, up to 550 μm broad. Asci 150-200 × 17-20 μm. Ascospores elongate-clavate, 9-13 septate, 55-85 × 7.5-12 μm, narrowly tapering to a rounded base and with a rounded apex.

Sporodochia pulvinate to subglobose up to 625 μm broad, yellow to orange yellow of loose textura intricata towards the inside and textura angularis on the outer layer. Conidiogenous cells blastic, densely aggregated on the surface developing from the cells lining the basal region of the sporodochium, moniliform, sparsely branched near the apex, 40-60 × 4-7.5 μm. Conidia mostly with 4-arms, rarely with 2-7 arms, each arm 125-180 × 6-9 μm, elongate fusiform with acute apex; arms united at the base by globose cell with a truncate base where the conidium secedes from the conidiogenous cell, rarely with a second cell below the basal cell.

On scale insects including *Parlatoria zizyphi* inhabiting *Citrus aurantium* and *C. nobilis*. Brazil and Formosa.

P. coccicola (Ell. & Ev.) Petch, *Trans.Br.mycol.Soc.* **7:** 146, 1921 (Fig. 351).

Nectria coccicola Ell. & Ev., *J. Mycol.* **2:** 39, 1886.
Ophionectria coccicola (Ell. & Ev.) Berl. & Vogl., *Add.Syll.Fung.* 1-4: 218, 1886.
Dialonectria coccicola (Ell. & Ev.) Ell. & Ev., *J. Mycol.* **2:** 137, 1886.
Scoleconectria coccicola (Ell. & Ev.) Seaver, *Mycologia* **1:** 198, 1909.
Scleroderris gigaspora Massee, *Kew Bull.* **1910:** 3, 1910.
Puttemansia coccicola (Ell. & Ev.) Höhnel, *Sber.Akad.Wiss.Wien* **120:** 408, 1911.

Anamorph: *Tetracrium coccicolum* Höhnel, *Sber.Akad.Wiss.Wien* **120:** 408, 1911 (as '*coccicola*').

Pseudothecia single or densely aggregated, on a white, byssoid stroma, up to 600 μm broad, smooth to scurvy, dirty white to light brown, rarely with hyaline hyphae. Asci 180-290 × 17-30 μm. Ascospores elongate clavate, 15-21 septate, faintly verruculose, 110-190 × 7.5-9 μm, parallel to spirally twisted in the ascus, with a rounded apex and narrowly tapering rounded base.

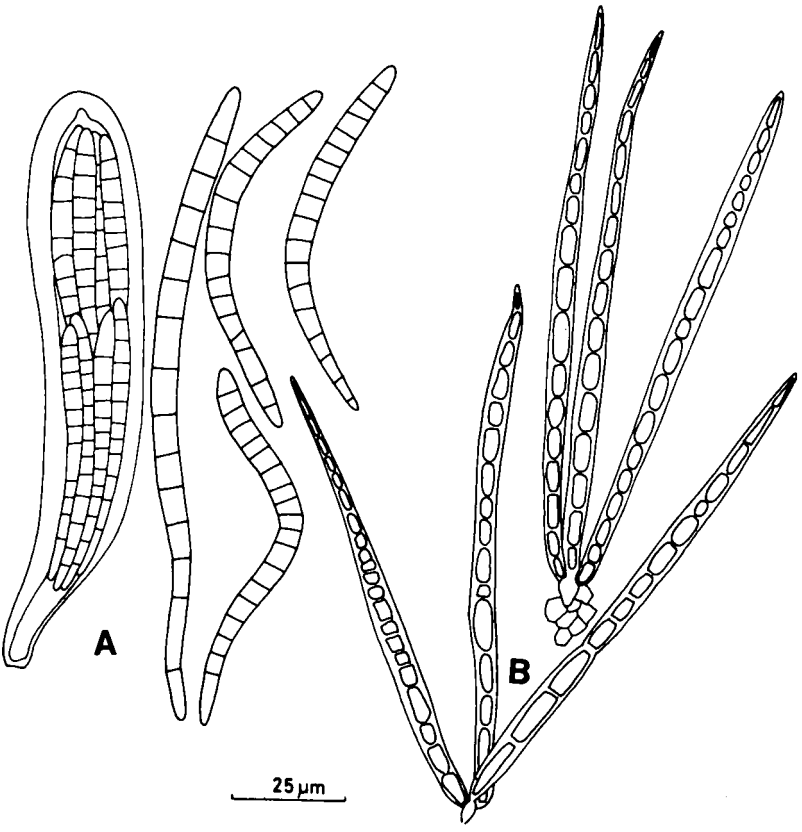


Fig. 351. *Podonectria coccicola*. A, ascus and ascospores; B, conidia.

Sporodochia stromatic, white to cream, tough to cartilaginous, pulvinate up to 800 µm broad composed of hyaline cells forming a textura epidermidea in the basal and central region and a textura angularis toward the margin. Conidiogenous cells moniliform, pale yellow, sparsely branched, densely crowded on the surface of the sporodochium, blastic, 20-30 × 4-7 µm. Conidia hyaline with 3, rarely 4-5 arms; each arm 72-215 × 6-7.5 µm, long fusoid with acute apex, middle arm usually longest; arms united at the base by a globose cell with a truncate base where the conidium secedes.

On scale insects, *Aspidotus ficus, A. pernicosus, Chionaspis citri, Lepidosaphes beckii, L. gloverii, Leucaspis* sp., *Mytilaspis citricola, M. gloverii, Parlotoria pergandii* and *P. zizyphi* inhabiting citrus trees *C. aurantium, C. nobilis, C. pomelanus* and *C. sinensis* and dicots,

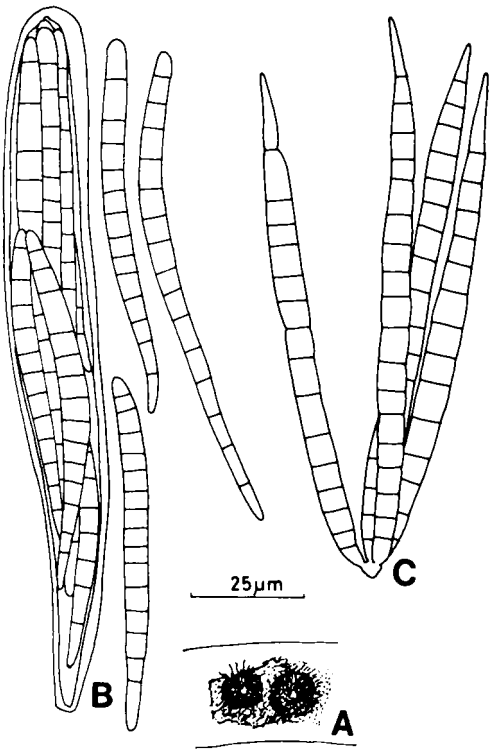


Fig. 352. *Podonectria echinata* (type). A, pseudothecia; B, ascus and ascospores; C, conidium.

Brachyglottis repanda, Coprosoma australis and *Melicytus ramiflorus.* Cosmopolitan in tropical and subtropical regions.

P. echinata Petch., *Trans.Br.mycol.Soc.* **7:** 151, 1921 (Fig. 352).

Anamorph: *Tetracrium echinatum* Petch, *Trans.Br.mycol.Soc.* **7:** 162, 1921.

Pseudothecia scattered or aggregated on a scant byssoid, white stroma, up to 420 µm broad, light yellow to yellow, covered with deltoid fascicles of hyaline hyphae. Asci 135-175 × 20-25 µm. Ascospores elongate clavate, 9-15 septate, vermiform, 100-125 × 5-8 µm.

Sporodochia pulvinate, orange to chestnut brown, up to 400 µm wide. Conidiogenous cells moniliform, sparsely branched near the apex,

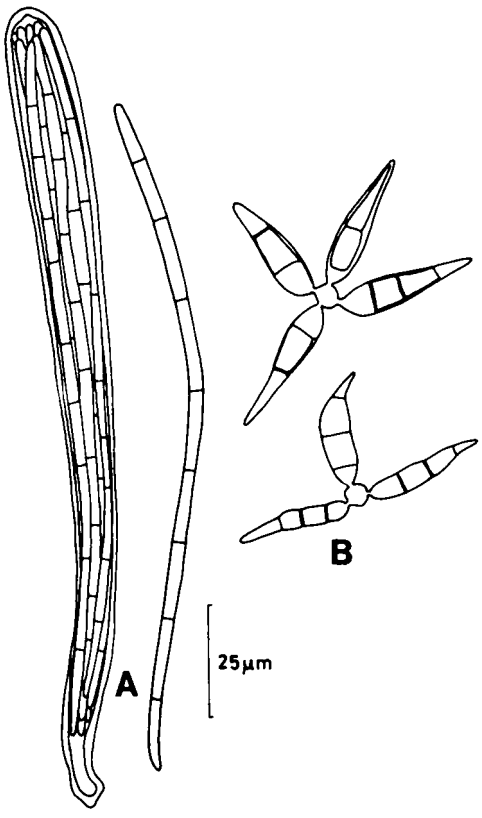


Fig. 353. *Podonectria gahnia* (type). A, ascus and ascospores; B, conidia.

blastic, 20-30 × 4-7 µm. Conidia with 3-4 arms, each arm elongate fusoid, 100-180 × 6-8 µm, 9-21 septate; arms united at the base by a globose cell where the conidium secedes.

On scale insects, *Lepidosaphes* sp., inhabiting *Citrus nobilis*. Sri Lanka.

P. gahnia Dingley, *Trans.&Proc.Roy.Soc.N.Z.* **81:** 498, 1954 (Fig. 353).

Anamorph: *Tetranacrium* sp.

Pseudothecia gregarious, immersed in a well developed outer stroma, up to 310 µm broad, brown to dark brown. Asci 135-190 × 12-18 µm. Ascospores elongate clavate to cylindric, curved to vermiform, 9-11 septate, 90-130 × 3.5-6 µm, tapering to rounded ends.

Pycnidia similar to pseudothecia, somewhat involuted, ostiolate, immersed in the outer stroma with pseudothecia. Conidiogenous cells moniliform, dense, lining the base and sides of the pycnidial cavity, formed from the cells lining the cavity, blastic. Conidia with 3-4 arms, each arm obclavate, 1-3 septate, 20-40 × 5-6 μm, arms united at the base by a globose cell with a truncate base where the conidium secedes.

On scale insects including diaspid, mostly unidentified insects inhabiting *Gahnia setifolia, G. xanthocarpa* and *Podocarpus ferrugineus*. New Zealand.

THAXTERIELLA Petrak, *Annls mycol.* **22:** 63, 1924.

Type sp.: *T. pezizula* (Berk. & M.A. Curtis) Petrak (= *T. corticola* Petrak).

Anamorph: *Helicoma* Corda

The genus comprises four species, *T. pezizula, T. lignicola* Teng (1936), *T. indica* Dharne & E. Müller (1970) and *T. roraimensis* Samuels & E. Müller. The anamorph is known only for *T. pezizula* and *T. roraimensis*. Barr (1980) treats *Thaxteriella* as a synonym of *Tubeufia*.

Pseudothecia superficial, black, fleshy globose to turbinate, when collapsed cupulate, partly embedded in a superficial subiculum, solitary or densely aggregated, with short acute papilla at the apex. Mycelium forming dense, velvety layer over the surface of the decorticated wood, composed of stiff, erect, unbranched or rarely branched, black hyphae with straight, acute or subacute tips, mixed with conidiophores. The pseudothecial wall is smooth, sometimes shiny, composed of thick-walled, dark brown cells on the outside. The apical region is composed of less thick-walled cells which disintegrate to form an ostiole. Asci cylindrical to broadly clavate or subclavate, 8-spored, thickened at the apex, short stalked. Ascospores cylindrical to fusiform, tapering towards the rounded to subacute ends, multiseptate, straight or curved, sometimes consticted in some of the septa, hyaline, becoming pale yellow brown after liberation. Pseudoparaphyses filamentous, hyaline, branched, anastomosing, attached to the hymenium and to the ascomatal wall above.

On decorticated wood of dicots. Commonly found in the tropics. Samuels, Rossman & Müller (1978) have discussed the relationship of this genus to some species of *Tubeufia* Penz. & Sacc. and indicated the close similarity in both the teleomorph and the anamorph.

The conidiophores of *Helicoma* anamorph arise as lateral branches from the superficial hyphae, simple or rarely branched, straight or flexuous, septate, olivaceous brown to brown, paler towards the apex. Conidiogenous cells polyblastic or monoblastic, integrated, terminal or intercalary, determinate, sympodial, cylindrical, denticulate; denticles cylindrical. Conidia solitary, dry, borne at the apex and on the sides of the conidiophore, simple, helicoid, hyaline to brown or pale brown, smooth, multiseptate.

Key to Thaxteriella species

Anamorph present..... 1

Anamorph not known..... 2

1. Ascospores 2-10 septate, 24-43 × 3.5-6.5 μm, conidia up to 10 septate, coils 16-25 μm in diam..... *T. roraimensis*

   Ascospores 5-12 septate, 35-60 × 7-10 μm, conidia up to 12 septate, coils 17-21 μm in diam..... *T. pezizula*

2. Ascospores 7-8 septate, 30-45 × 5-6.5 μm..... *T. lignicola*

   Ascospores 15-20 septate, 60-100 × 9-12 μm..... *T. indica*

T. pezizula (Berk. & M.A. Curtis) Petrak, *Sydowia* **7:** 110, 1953 (Fig. 354).

Sphaeria pezizula Berk. & M.A. Curtis, *Grevillea* **4:** 106, 1876.
Sphaeria helicophila Cooke, *Grevillea* **6:** 145, 1878.
Melanomma helicophilum (Cooke) Sacc., *Syll. Fung.* **2:** 112, 1883.
Lasiosphaeria pezizula (Berk. & M.A. Curtis) Sacc., *Syll.Fung.* **2:** 195, 1883.
Byssosphaeria helicophila (Cooke) Cooke, *Grevillea* **15:** 123, 1887.
Herpotrichia pezizula (Berk. & M.A. Curtis) Ell. & Ev., *North Am.Pyren.:* 160, 1892.
Herpotrichia chilensis Speg., *Rev.Fac.Agron.Vet.La Plata* **6:** 66, 1910.
Thaxteriella corticola Petrak, *Annls mycol.* **22:** 63, 1924.
Tubeufia pezizula (Berk. & M.A. Curtis) Barr, *Mycotaxon* **12:** 157, 1980.

Anamorph: *Helicoma muelleri* Corda, *Icon.Fung.* **1:** 15, 1837.

Helicoma curtisii Berk., *Grevillea* **3:** 106, 1875.
Helicosporium muelleri (Corda) Sacc., *Michelia* **2:** 129, 1880.
Helicomyces muelleri (Corda) Pound & Clem., *Bull.Minn.Geol.nat.Hist.Surv.* **9:** 659, 1896.
Helicomyces curtisii (Berk.) Pound. & Clem., *loc.cit.* 1896.
Helicosporium tiliae Peck, *Bull.Torrey bot.Club* **34:** 103, 1907.

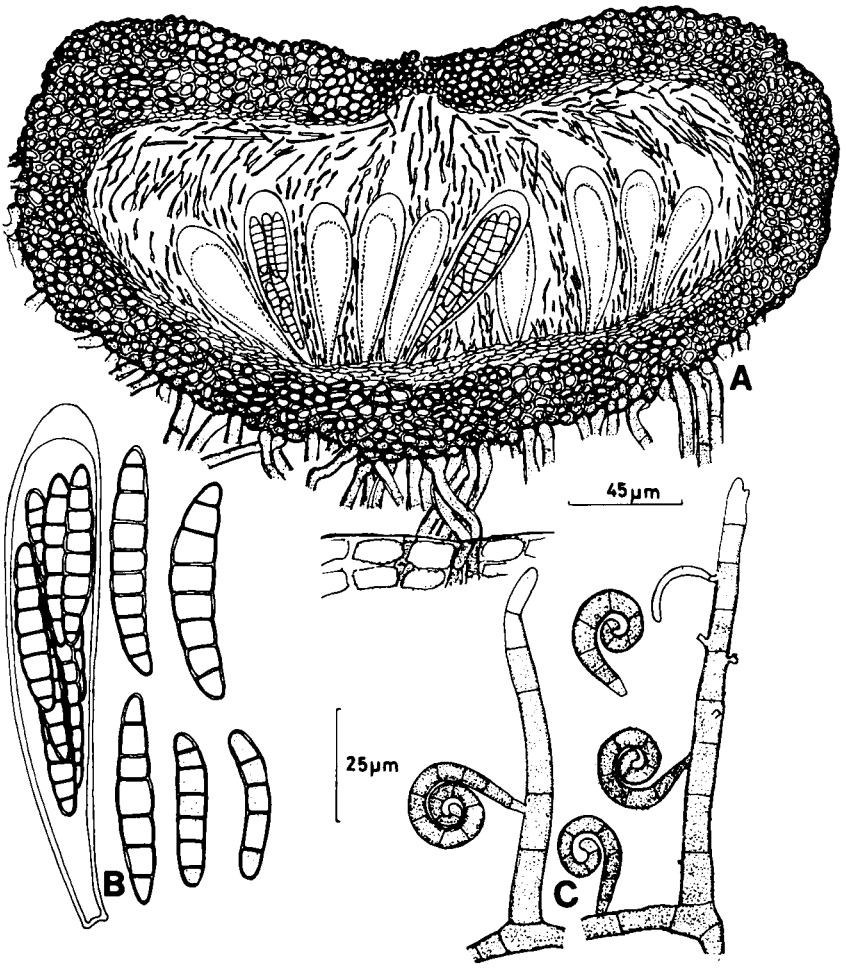


Fig. 354. *Thaxteriella pezizula* (type). A, v.s. of pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

Pseudothecia up to 400 µm broad, partly embedded in a superficial subiculum, single or aggregated into stroma. Asci 100-140 × 15-20 µm. Ascospores cylindrical, slightly tapering towards the rounded ends, granular, staight to curved, hyaline to pale yellow brown after liberation, 5-12 septate, mostly 6-8 septate, 35-60 × 7-10 µm.

Conidiophores up to 180 µm long. Conidia mostly pleurogenous, borne on cylindrical pegs arising from the cells of the conidiophore, 1 1/2-1 3/4 times coiled, hyaline to pale olivaceous brown, 17-21 µm in diam., 5-12 septate, 3-6 µm thick.

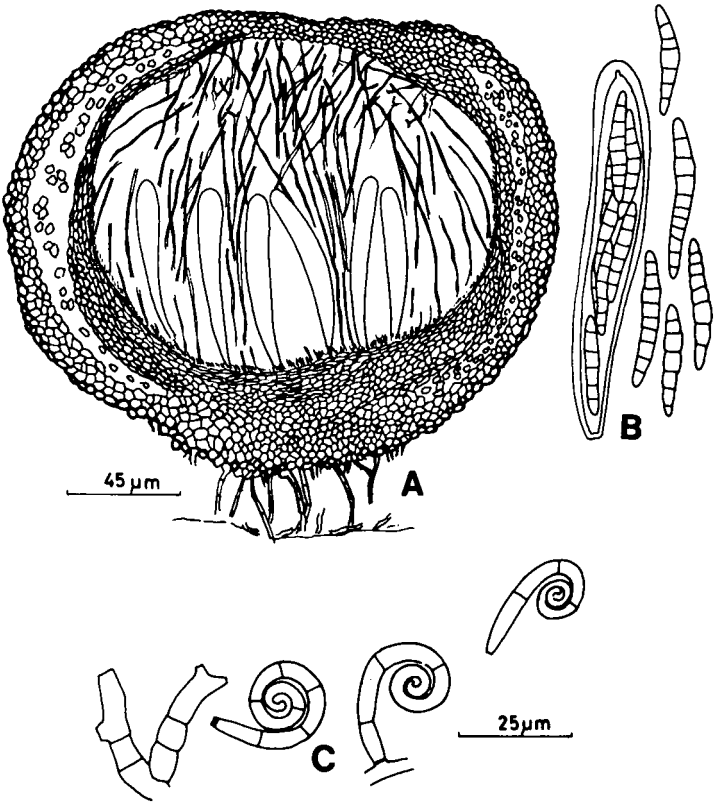


Fig. 355. *Thaxteriella roraimensis* (type). A, v.s. of pseudothecium; B, ascus and ascospores; C, conidiophores and conidia.

Common on wood and bark of deciduous trees. Europe, Africa, Bermuda, Canada, Grenada, India, Jamaica, Sri Lanka, Puerto Rico and U.S.A. Pirozynski (1972) has illustrated and described this species in detail.

T. roraimensis Samuels & E. Müller, *Sydowia* **31:** 137, 1978 (Fig. 355).

Anamorph: *Helicoma* sp.

Pseudothecia turbinate to globose with shiny, smooth wall composed of a middle layer devoid of cells when sectioned, presumably due to pressure applied during sectioning. Asci 70-112 × 10-17 µm. Ascospores fusoid with acute ends, 2-10 septate, usually the cell above the median septum wider, constricted at first at the median septum, later at other septa, hyaline to pale brown, 24-43 × 3.5-6.5 µm.

Conidia coiled 2-3 times in one plane, up to 10 septate, 16-25 μm in diam, borne on cylindrical denticles 2.5 μm broad with a thickened cicatrized scar remaining after conidial liberation and often with a fine basal frill.

On decorticated wood. Brazil.

Thaxteriellopsis lignicola Sivan., Panwar & Kaur (*Kavaka* **4:** 39, 1976) the type of *Thaxteriellopsis,* has been connected to *Moorella speciosa* R.Rao & D.Rao by Sekar & Subram. (personal communication, *Proc.Ind.Acad.Sci.* 1982, in press). This is very close to *Thaxteriella* from which it differs by dictyoseptate ascospores. *Chaetosphaerulina yasudae* Hino has been connected to *Xenosporium indicum* Panwar, Purohit & Gehlot by Subram. & Sekar (*Kavaka* **8:** 73, 1980). The descriptions of *C. yasudae* by Subram & Sekar suggest that it is not this species but a *Thaxteriellopsis, T. bambusicola* Sivan. & N.D. Sharma, *Trans.Br.mycol.Soc.* **81:** 321, 1983 with *Xenosporium indicum* anamorph and with dictyoseptate ascospores. Ascospores in *Chaetosphaerulina* are transversely multi-septate and not dictyoseptate.

TUBEUFIA Penz & Sacc., *Malpighia* **11:** 517, 1897.

Chaetosphaerulina Hino, Bull. *Miyazaki Coll.Agric.For.* **10:** 62, 1938.

Lectotype sp.: *T. paludosa* (Cr. & Cr.) Rossman, *Mycologia* **69:** 383, 1977.
(According to Samuels, Rossman & Müller (1978) the actual identity of the type species is doubtful).

Anamorphs: *Helicosporium* Nees: Fr., *Helicomyces*-like, *Monodictys*-like, and *Asteromella*-like.

Pseudothecia solitary or gregarious, superficial, globose to clavate, pyriform or doliiform, white, orange, bright yellow, dull yellow, pale yellow, brown to black, smooth to rugose occasionally hairy, fleshy, waxy, non subiculose or with black superficial hyphae growing into the substrate from the base of the pseudothecia. The pseudothecial wall is pseudoparenchymatic. Asci clavate to broadly cylindrical, 4-8 mostly 8 spored. Ascospores fusiform, multiseptate, hyaline to pale yellow or brown, smooth, not constricted at the septa. Ascospores germinate either by long branched or unbranched germ tubes formed terminally and laterally or by terminal and lateral phialides. Pseudoparaphyses filiform, hyaline, septate, branched.

Helicosporium: Colonies hairy or cottony, bright coloured or brown. Mycelium partly superficial or immersed. Conidiophores unbranched or loosely branched, straight to flexuous, smooth to finely echinulate, apex

often setiform. Conidiogenous cells polyblastic to monoblastic, integrated intercalary and sometimes terminal, sympodial, determinate or proliferating 2-3 times, denticulate, without scars or with cicatrized scar with a pore in the centre (poroconidia). Conidia dry, solitary, borne at the tip and on the sides of the conidiophore, simple helicoid, hyaline to brightly coloured in mass, filaments multiseptate, smooth, hygroscopic.

Chaetosphaerulina, typified by *C. yasudae* Hino *(Bull. Miyazaki Coll. Agric.For.* **10:** 62, 1938 as *'yasudai')* belongs to *Tubeufia* and is transferred as *T. yasudae* (Hino) comb. nov. The other species *C. vermicularispora* Hino & Katumoto (*Bull.Fac.Agric. Yamaguti Univ.* **5:** 225, 1954) is also transferred to *Tubeufia* as *T. vermicularispora* (Hino & Katumoto) comb. nov. Pirozynski (1972) placed these two species and *T. nigrotuberculata* in *Herpotrichia* but this is unacceptable on account of their fruit body structure, ascus and ascospore characters.

Key to Tubeufia species with anamorphs

Ascospores 12 or more septate, 55-95 × *6-8* μm..... *T. helicoma*

Ascospores 12 or less than 12 septate..... 1

1. Ascospores 3-5 septate, 25-35 × 3-4 μm..... *T. amazonensis*

   Ascospores 5 or more septate..... 2

2. Ascospores 5-9 septate, 30-50 × 3-4 μm..... *T. palmarum*

   Ascospores 5-12 septate, 45-80(150) × 3-5 μm..... *T. paludosa*

   Ascospores 7-12 septate, 30-50 × *3-5* μm..... *T. cerea*

T. amazonensis Samuels, Rossman & E. Müller, *Sydowia* **31:** 186, 1978 (Fig. 356A,B).

Anamorphs: *Monodictys*-like and *Asteromella*-like (Samuels, Rossman & Müller, 1978).

Pseudothecia non stromatic, black, fleshy, non papillate, with a smooth wall, collapsing when dry, up to 240 μm broad. Asci 60-80 × 10-15 μm. Ascospores fusiform, 3-5 septate, not constricted at the septa, 25-35 × 3-4 μm, with rounded ends.

Anamorph formed in culture. Colonies dark brown to olivaceous, hyphae immersed, smooth to spinulose, swollen. Conidiogenous cells lateral on hyphae, the initial cell dividing to form a stalk and an apical

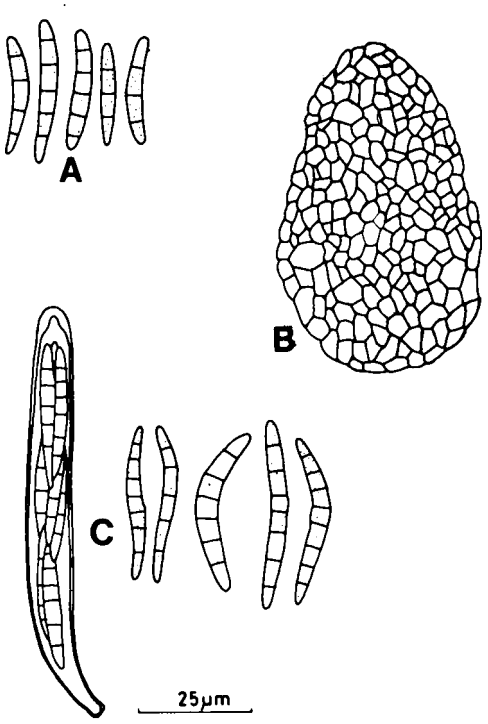


Fig. 356. *Tubeufia amazonensis* (type). A, ascospores; B, conidium. *T. palmarum*. C, ascus and ascospores.

cell which divides repeatedly to form darkly pigmented, muriform, elongated conidia. Conidia composed of pseudoparenchymatous cells with the apex remaining paler coloured, measuring 100-140 × 50-70 µm. Sometimes the apical region of the conidium forms conidiogenous locules.

Asteromella-like pycnidia formed in the same manner but the cellular mass remaining in the form of a ball, 30-40 µm diam., enclosed in a thin amorphous membrane, light brown. Conidiogenous cells phialidic, almost globose, 3-5 µm in diam., and all the cells of the ball are apparently conidiogenous. Conidia allantoid to rod-shaped, hyaline 3-4 × 1-1.5 µm.

On decorticated wood. Brazil.

According to Samuels, Rossman & Müller (1978) the *Monodictys*-like state is similar to *M. lepraria* (Berk.) M.B. Ellis.

T. cerea (Berk. & M.A. Curtis) Höhnel, *Sber.Akad.Wiss.Wien* **128:** 562, 1919 (Fig. 357).

Sphaeria cerea Berk. & M.A. Curtis, *Grevillea* **4:** 108, 1876.
Calonectria cerea (Berk. & M.A. Curtis) Sacc., *Syll.Fung.* **2:** 551, 1883.
Dialonectria cerea (Berk. & M.A. Curtis) Cooke, *Grevillea* **12:** 111, 1884.
Ophionectria briardi Boud., *Rev.Mycol.* **7:** 226, 1885.
Nectria fulvida Ell. & Ev., *J. Mycol.* **1:** 140, 1885.
Calonectria fulvida (Ell. & Ev.) Berl. & Vogl., *Add.Syll.Fung.* 1-4: 122, 1886.
Dialonectria fulvida (Ell. & Ev., *J. Mycol.* **2:** 122, 1886.
Ophionectria episphaeria P. Karsten, *Hedwigia* **28:** 26, 1889.
Ophionectria everhartii Ell. & Galloway, *J. Mycol.* **6:** 32, 1890.
Ophionectria cerea (Berk. & M.A. Curtis) Ell. & Ev., *North Am. Pyren.:* 118, 1892.
Calonectria belonospora Schroeter in Cohn, *Krypt.Fl.Schlesien* **3:** 261, 1894.
Ophionectria belonospora (Schroeter) Sacc., *Syll.Fung.* **11:** 365, 1895.
Ophionectria briardi Boud. var. *longipila* Starb., *Bot.Not.* 1898: 218, 1898.
Ophionectria belonospora (Schroeter) Sacc. var. *unicaudata* Feltgen, *Vorstud. Pilze Luxemb.Nachtr.* **3:** 308, 1903.
Ophionectria cupularum Kirschst., *Verh.Bot.Vereins Prov.Brandenb.* **48:** 60, 1906.
Tubeufia cerea (Berk. & M.A. Curtis) Barr in Bigelow & Barr, *Rhodora* **65:** 307, 1963.
Tubeufia cerea (Berk. & M.A. Curtis) C. Booth, *Mycol.Pap.* **94:** 11, 1964.
Ophionectria annonae R.Rao, *Sydowia* **25:** 72, 1971.

Anamorph: *Helicosporium virescens* (Pers.) comb. nov.

Dematium virescens Pers., *Romers Neues Mag.Bot.* **1:** 121, 1794.
Dematium virescens Pers., *Syn.Meth.Fung.:* 698, 1801.
Helicosporium vegetum Nees, *Syst.Pilze Schwamme:* 68, 1817.
Helicotrichum pulvinatum Nees & T. Nees, *Nova Acta Acad.Caes.Leop.* **9:** 246, 1818.
Helicotrichum vegetum (Nees) Wallr., *Fl.Crypt.Germ.* **2:** 161, 1833.
Helicomyces vegetus (Nees) Corda, *Icon.Fung.* **1:** 9, 1837.
Helicomyces aureus Corda, *Icon Fung.* **1:** 9, 1837.
Helicosporium olivaceum Peck, *Rep.N.Y.St.Mus.* **27:** 102, 1875.
Helicomyces vegetus (Nees) Pound & Clem., *Bull.Minn.Geol.Nat.Surv.* **9:** 659, 1896.
Helicosporium aureum (Corda) Linder, *Ann.Mo.bot.Gdn* **16:** 279, 1929.

The teleomorph and the anamorph are in close association with organic connection.

Pseudothecia on effete stroma of *Diatrype stigma* and other ascomycetes, black, globose to pyriform, rugose, up to 240 μm broad, hairy mostly on the upper half. Asci 65-120 × 9-12 μm. Ascospores fusoid, hyaline, 7-12 septate, 30-50 × 3-5 μm.

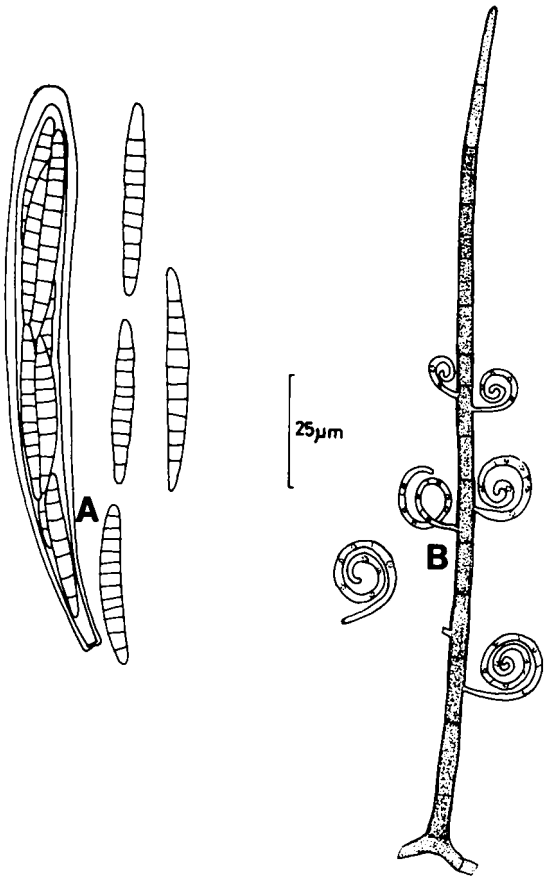


Fig. 357. *Tubeufia cerea* (type). A, ascus and ascospores; B, conidiophore and conidia.

Conidial colonies hairy, bright lemon to yellow. Conidiophores up to 400 μm long. Conidia lateral, mostly on the lower region, helically coiled 2-3 times in one plane, hyaline, greenish in mass, 10-20 μm in diam. Filaments about 1 μm thick, septa when present indistinct.

Common on wood and bark lying in the ground. Europe, India and N. America.

T. helicoma (Phill. & Plowr.) Piroz., *Mycol.Pap.* **129:** 30, 1872 (Fig. 358).

Sphaeria helicoma Phill. & Plowr., *Grevillea* **6:** 26, 1877.

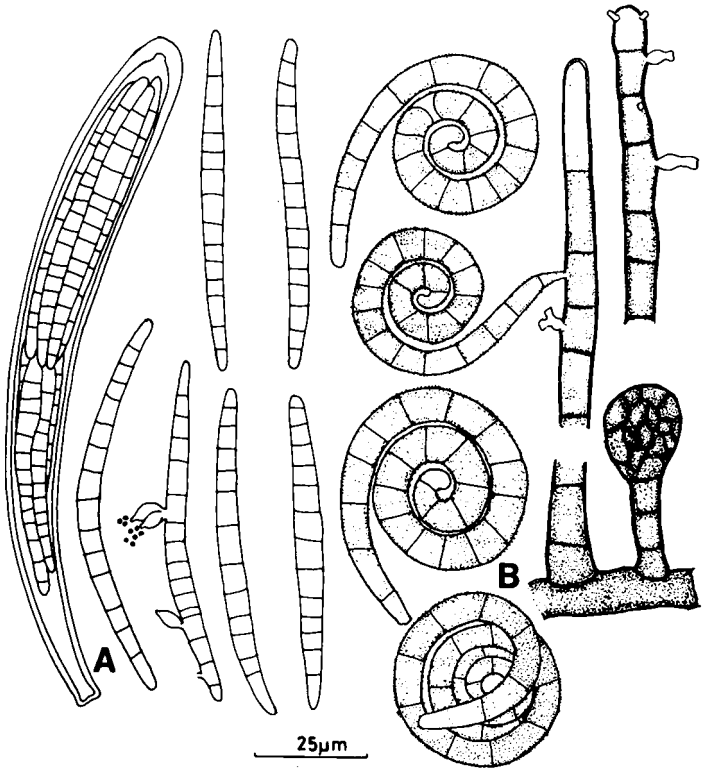


Fig. 358. *Tubeufia helicoma* (type). A, ascus and ascospores; B, conidiophores and conidia.

Lasiosphaeria helicoma (Phill. & Plowr.) Cooke, *Grevillea* **7:** 85, 1879.
Tubeufia rugosa C. Booth, *Mycol.Pap.* **94:** 13, 1964.

Anamorph: *Helicosporium pannosum* (Berk. & M.A. Curtis) R.T. Moore, *Mycologia* **49:** 582, 1957.

Drepanospora pannosa Berk. & M.A. Curtis in Berk., *Grevillea* **3:** 105, 1875.
Helicosporium serpentinum Linder, *Ann.Mo.bot.Gdn* **16:** 288, 1929.
Helicosporium nematosporum Linder, *ibid.*
Helicosporium elinorae Linder, *ibid.*

Pseudothecia subglobose to ovoid, up to 300 µm broad, black. Asci 110-150 × 16-20 µm. Ascospores hyaline to pale brown, 12-20 septate, 55-95 × 6-8 µm.

Conidiophores smooth to finely echinulate, up to 350 µm long. Conidia formed singly and terminally on lateral peg-like subhyaline outgrowth

from the cell of the conidiophore, with rarely the apical cell of the conidiophore functioning as a conidiogenous cell. Conidia subhyaline to pale brown, minutely echinulate, variable in shape, sometimes 1 1/2-5 times tightly coiled in one plane, 20-50 μm in diam., sometimes unwound, loosely coiled to vermiform. The filament 2.5-13.5 μm wide, 12-60 septate, often bears one or more lateral secondary conidia which are vesicle-like outgrowths from the inner wall, thick-walled and dark chestnut above, thin-walled and hyaline below.

On rotten wood. Brazil, British Guiana, Chile, Great Britain, New Zealand, Tanzania and U.S.A.

The teleomorph and the anamorph are found in close association with organic connection.

T. palmarum (Torrend) Samuels, Rossman & E. Müller, *Sydowia* **31:** 189, 1978 (Fig. 356C).

Ophionectria palmarum Torrend, *Bull.Jard.Bot.Etat.* **4:** 8, 1914.

Anamorph: *Helicomyces*-like (Samuels, Rossman & Müller, 1978).

Pseudothecia non stromatic, fleshy, bright orange to bright yellow, darker and dull yellow when dry, up to 300 μm broad. Asci 75-110 × 7-10 μm. Ascospores fusiform, 5-9 septate, constricted at the median septum, hyaline to pale yellow, 30-50 × 3-4 μm, with subacute to rounded ends.

Conidial state produced in culture by Samuels, Rossman & Müller (1978). Hyphae light olivaceous yellow. Conidiophores indeterminate. Conidiogenous cells polyblastic or monoblastic, intercalary, sympodial, determinate or proliferating 2-3 times, denticulate. Denticles narrow, acute, thin-walled. Conidia dry, solitary, arising along the length of the conidiophore, coiled or hook-shaped, non septate, 4-6 μm in diam. Filament 1.5-2 μm wide.

On leaves and cortex of palms and on other ascomycete stroma. Brazil, Zaire.

T. paludosa (Crouan & H. Crouan) Rossman, *Mycologia* **69:** 383, 1977 (Fig. 359).

Nectria paludosa Crouan & H. Crouan, *Fl. Finistere:* 38, 1867.
Ophionectria paludosa (Crouan & H. Crouan) Sacc., *Michelia* **1:** 323, 1878.
Tubeufia anceps Penz. & Sacc., *Malpighia* **11:** 518, 1897.
Tubeufia coronata Penz. & Sacc., *ibid.:* 517, 1897.

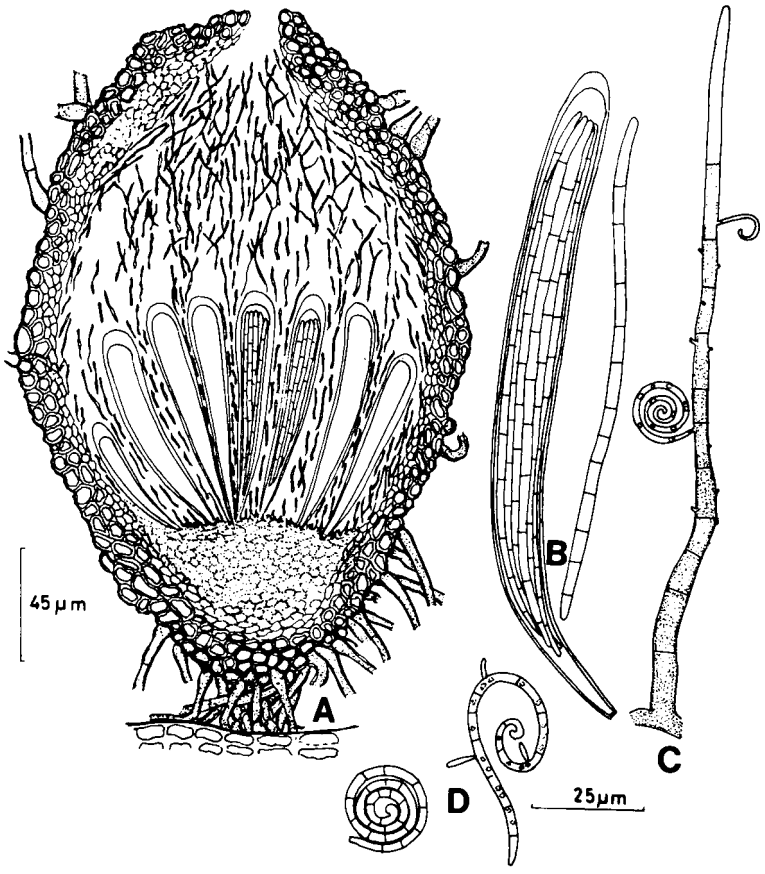


Fig. 359. *Tubeufia paludosa.* A, v.s. pseudothecium; B, ascus and ascospores; C, conidiophore; D, conidia.

Tubeufia javanica Penz. & Sacc., *ibid.:* 517, 1897.
Tubeufia helicomyces Höhnel, *Sber.Akad.Wiss.Wien* **68:** 1477, 1909.
Tubeufia cylindrothecia (Seaver) Höhnel, *ibid.* **68:** 1479, 1909.
Ophionectria cylindrothecia Seaver, *Mycologia* **1:** 70, 1909.
Ophionectria anceps (Penz. & Sacc.) Höhnel, *Sber.Akad.Wiss.Wien* **128:** 562, 1919.
Ophionectria hidakaeana Hino & Katumoto, *Bull.Fac.Agric.Yamaguti Univ.* **6:** 41, 1955.
Tubeufia cylindrothecia (Seaver) C. Booth, *Mycol.Pap.* **94:** 15, 1964.

Anamorph: *Helicosporium phragmitis* Höhnel, *Annls mycol.* **3:** 338, 1905.

Pseudothecia pale yellow, later brown to black when dry, elongate, ovoid to clavate, up to 300 μm broad. Asci 135-225 × 9-11 μm. Ascospores fusiform with acute ends, 5-12 septate, not constricted at the septa, hyaline, 45-80 (150) × 3-5 μm.

Conidiophores up to 370 μm long, upper part frequently sterile, often forked near the base, tapering towards the apex. Conidia helically 2-4 times coiled in one plane, hyaline, pink in mass, 14-21 μm diam; filaments 1.5-2.5 μm thick, 7-12 septate.

Barr (1980) separates *T. cylindrothecia* from *T. paludosa* by shorter ascospores.

Webster (1951) demonstrated the connection between the telemorph and the anamorph by producing the anamorph from ascospores. Samuels, Rossman & Müller (1978) reported that the conidia are poroconidia formed on a conidiogenous locus which appears as a refractive, rounded, cicatrized scar with a pore in the centre.

On decaying culms of *Arrhenatherum, Glyceria, Phalaris, Phragmites* in damp situations and on lignified and non lignified plant debris. Bermuda, Brazil, Colombia, India, Indonesia, Europe, Panama, Trinidad, U.S.A. and Venezuela.

Venturiaceae Müller & von Arx ex Barr

Pseudothecia immersed, erumpent, superficial, depressed globose to conical, solitary, aggregated on a stroma or as locules in a stroma, sometimes clypeate, often setose or hairy, with short papillate ostioles. Ascospores hyaline, olive green, olivaceous or brown, one septate. Pseudoparaphyses filamentous, septate, often thin walled or deliquescing.

Anamorphs: *Cladosporium* Link: Fr., *Fusicladium* Bonordon, *Piggotia* Berk. & Br., *Pollaccia* Baldacci & Cif., *Sclerophoma* Höhnel and *Spilocaea* Fr. I have now discovered *Fusicladium* and *Stigmina* anamorphs for *Acantharia; Stigmina, Virgariella* and an undescribed hyphomycete anamorphs for some *Gibbera* species. A paper dealing with these will appear in the *Trans.Br.mycol.Soc.* **82**(3) in 1984.

Parasitic on higher plants.

Key to Genera of Venturiaceae with anamorphs

Ascospores strictly septate near the lower or upper end..... 1

Ascospores not so..... 3

1. Ascospores septate near the lower end..... 2

   Ascospores septate near the upper end..... *Atopospora*

2. Superficial subiculum present, pseudothecia unilocular..... *Apiosporina*

   Superficial subiculum absent, stroma multilocular..... *Platychora*

3. Pseudothecia clustered on a sterile stalked stroma..... *Xenomeris*

   Pseudothecia not clustered on a stalked stroma..... *Venturia*

APIOSPORINA Höhnel, *Sber.Akad.Wiss.Wien* **119:** 439, 1910.

Dibotryon Theiss. & H. Sydow, *Annls mycol.* **13:** 663, 1915.
Parodiodia Bat. in Bat. et al., *Saccardoa* **1:** 9, 1960.

Type sp.: *A. collinsii* (Schwein.) Höhnel, *Sber.Akad.Wiss.Wien* **119:** 439, 1910.

Anamorphs: *Cladosporium* Link: Fr. and *Fusicladium* Bonorden

Subiculum black, thin, composed of dark brown hyphae. Hypostroma immersed, few. Ascostromata on the subiculum or on the surface of stroma, black, globose to turbinate, gregarious, with a tapering base of stromatic cells and an irregular ostiole formed lysigenously. The ascostromatal wall is composed of dark brown to black angular or prismatic cells on the outside and less pigmented to hyaline tangentially flattened cells towards the inside. Asci clavate to short cylindric, 8 spored. Ascospores pale green to yellow brown or olivaceous, obovoid, fusoid or clavate, apex obtusely rounded, base acute or pointed, one septate near the lower end. Pseudoparaphyses hyaline, septate, branching.

Key to Apiosporina species with anamorphs

Ascospores 12-15 × 4.5-6 μm..... *A. collinsii*

Ascospores 13-18 × 4-7 μm..... *A. morbosa*

A. collinsii (Schwein.) Höhnel, *Sber.Akad.Wiss.Wien* **119:** 439, 1910 (Fig. 360).

Sphaeria collinsii Schwein., *Trans. Amer. Phil. Soc.* **4:** 211, 1832.
Dimerosporium collinsii (Schwein.) Thüm., *Mycotheca Univ.* no. 849, 1877.
Parodiodia amelanchieris Bat., Farr. & Lima, *Saccardoa* **1:** 9, 1960 (as '*amelanchiera*').

Anamorph: *Cladosporium* sp.

Subiculum hypophyllous, black, superficial, thin, composed of dark brown hyphae with few hypostromatic hyphae in the host. Ascostromata on the subiculum, globose or turbinate, dark brown to black, up to 250 μm broad, ostiolate. The wall is composed of thick-walled, dark brown angular cells. Asci cylindrical to cylindric clavate, 8 spored, 40-70 × 9-13 μm. Ascospores pale green to yellow brown, one septate near the lower end, obovoid or fusiform, 12-15 × 4.5-6 μm, with an obtusely rounded apex and an acute to pointed base. Pseudoparaphyses hyaline, septate, sometimes branched.

Conidiophores arising from the superficial hyphae of the subiculum, simple, erect, sometimes branched, septate, cylindrical, brown, 30-225 μm long, 4 μm wide. Conidiogenous apex of the conidiophore denticulate bearing short, simple or branched chains of conidia. Conidia one celled, olive brown, ellipsoid, denticulate at one or both ends, sometimes 2-3 denticulate at the distal end, 8-18 × 5-9 μm.

On leaves of *Amelanchier*. North America, causing a witches, broom disease.

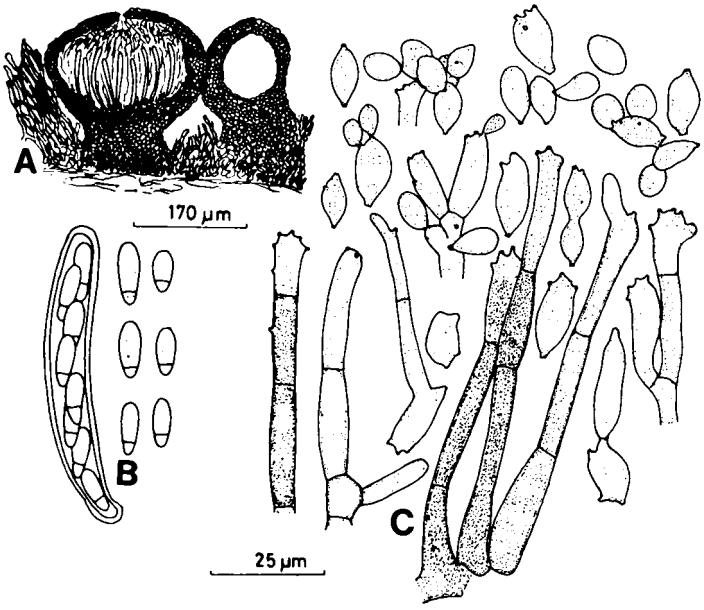


Fig. 360. *Apiosporina collinsii*. A, v.s. pseudothecia; B, ascus and ascospores; C, conidiophores and conidia.

A. morbosa (Schwein.) von Arx, *Acta Bot. Neerl.* **3:** 86, 1954 (Fig. 361).

Sphaeria morbosa Schwein., *Schrift. Naturf. Ges. Leipzig* **1:** 40, 1822.
Cucurbitaria morbosa (Schwein.) Ell., *North Amer. Fungi:* 691, 1881.
Plowrightia morbosa (Schwein.) Sacc., *Syll. Fung.* **2:** 638, 1883.
Otthia morbosa (Schwein.) Ell. & Ev., *North. Amer. Pyren.:* 251, 1892.
Dibotryon morbosum (Schwein.) Theiss. & H. Sydow, *Annls mycol.* **13:** 663, 1915.

Anamorph: *Fusicladium* sp. (M.B. Ellis, 1976).

Stromata developing in branches, erumpent, black, hard, composed of textura prismatica or angularis on the outside and mixed with hyphae and host cells inside. Ascostromata mixed with conidial stroma, black, globose, sometimes turbinate, attached by a base of stromatic cells, with a slightly flattened apex and central, depressed ostiole, up to 500 µm broad. The ascostromatal wall is composed of angular to prismatic cells. Asci clavate, sessile, 8 spored, 50-75 × 12-15 µm. Ascospores clavate, tapered towards the base, apex obtusely rounded, one septate near the lower end, olivaceous, 13-18 × 4-7 µm. Pseudoparaphyses hyaline, septate, branched.

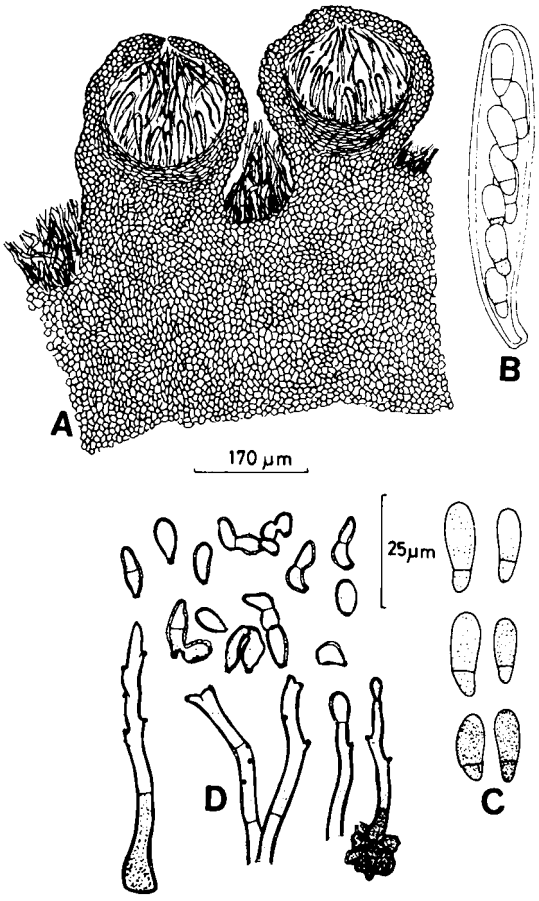


Fig. 361. *Apiosporina morbosa*. A, v.s. pseudothecia; B, ascus; C, ascospores; D, conidiophores and conidia.

Conidial stroma on branches, erumpent, hyphal towards the exterior, greenish. Conidiophores produced from the upper stromatic cells, erect, simple or branched near the base, pale brown, flexuous, smooth, geniculate with thickened lateral and terminal scars on small denticles, 40-70 × 5-7 µm. Conidia pale brown, ellipsoid, ovate, obovate or irregular in shape, 0-1 septate, smooth, formed terminally and laterally, singly or in irregular short chains, often fusing together, 6-13 × 3-5 µm.

Causes black knot of plum, damson, cherry, peach, apricot and other species of *Prunus,* Canada and U.S.A. Sutton & Waterston (1970a) have given a brief description of the morphology, symptoms, physiologic specialization, transmission and control of this fungus.

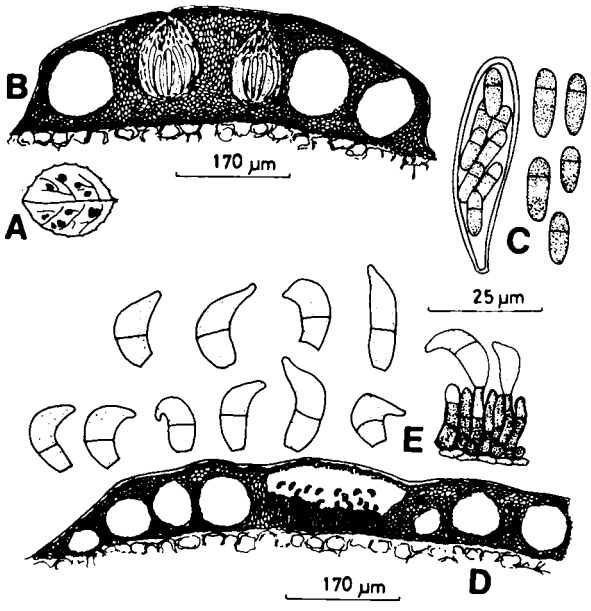


Fig. 362. *Atopospora betulina*. A, leaf with stromatic spots; B, v.s. ascostroma; C, ascus and ascospores; D, v.s. conidioma; E, conidiophores and conidia.

ATOPOSPORA Petrak, *Annls mycol.* **23:** 100, 1925.

Type sp.: *A. betulina* (Fr.) Petrak, *Annls mycol.* **23:** 101, 1925.

Conidial state associated with the type species is *Didymochora betulina* Höhnel. The only other species *A taxi* (Woronichin) E. Müller has no anamorph.

A. betulina (Fr.) Petrak, *Annls mycol.* **23:** 101, 1925 (Fig. 362).

Xyloma betulina Fr., *Obs. Mycol. Havniae* **1:** 198, 1815.
Dothidea betulina Fr., *Syst. mycol.* **2:** 554, 1823.
Phyllachora betulina (Fr.) Fuckel, *Symb. mycol.:* 217, 1869.
Dothidella betulina (Fr.) Sacc., *Syll. Fung.* **2:** 628, 1883.
Euryachora betulina (Fr.) Schroeter in Cohn *Krypt.-Fl. Schles.* 3(2): 474, 1897.
Rehmiodothis betulina (Fr.) von Arx, *Acta Bot. Neerl.* **3:** 83, 1954.

Anamorph: *Didymochora betulina* Höhnel, *Hedwigia* **60:** 172, 1918.

Stromata gregarious, epiphyllous, subcuticular, black, up to 0.5 mm across, with several ascogenous locules. Locules globose to broadly el-

lipsoid in a single layer, separated by rows of brownish, polygonal to flattened cells. The wall of the stromata is composed of 2-3 outer cell layers of dark brown to black, polygonal, thick-walled cells and several layers of brown polygonal to flattened cells towards the inside. Asci cylindric-clavate, thick-walled, 8 spored, 35-54 × 9-14 μm. Ascospores distichous in the ascus, elliptic-cylindric, septate towards the upper end of the spore, not or very slightly constricted at the septum, initially hyaline becoming yellowish to olivaceous when mature, 10-15 × 4-6 μm. Pseudoparaphyses septate, filiform.

Acervulus mixed with ascostroma, subcuticular, applanate or irregularly pulvinate, separate, black, with the lower wall pale to medium brown of textura prismatica, dehiscing by irregular rupture, up to 200 μm diam. Conidiophores simple, arranged in a palisade-like layer, pale brown to brown septate, cylindrical, straight, formed from the upper cells of the acervulus. Conidiogenous cells holoblastic, determinate, cylindrical, pale brown, smooth or verruculose above, 8-10 × 4-5 μm. Conidia pale brown to brown, one septate, curved, smooth or distantly verruculose, 15-23 × 8-9 μm, with a truncate base and acute apex.

On leaves of *Betula*. Europe.

PLATYCHORA Petrak, *Annls mycol.* **23:** 102, 1925.

Type sp.: *P. ulmi* (Schleich.: Fr.) Petrak, *Annls mycol.* **23:** 103, 1925. Two species known. The type species is associated with a *Piggotia* anamorph and the other, *P. alni* (Peck) Petrak has no anamorph.

P. ulmi (Schleich.: Fr.) Petrak, *Annls mycol.* **23:** 103, 1925 (Fig. 363).

Sphaeria ulmi Schleich. in DC., *Fl.Franc.* **2:** 288, 1805.
Sphaeria ulmi Schleich.: Fr., *Syst. mycol.* **2:** 555, 1823.
Sphaeria ulmi Duval, *Hoppes Bot. Taschenb.:* 105, 1809.
Dothidea ulmi (Schleich.: Fr.) Fr., *Syst. mycol.* **2:** 555, 1823.
Phyllachora ulmi (Schleich.: Fr.) Fuckel, *Symb.mycol.:218, 1870.*
Dothidella ulmi (Schleich.: Fr.) Winter in Rabenh., *Krypt.-Fl.* **1:** *904, 1887.*
Euryachora ulmi (Schleich.: Fr.) Schroeter in Cohn, *Krypt.-Fl. Schles.* **3:** 473, 1908.
Systremma ulmi (Schleich.: Fr.) Theiss. & H. Sydow, *Annls mycol.* **13:** 334, 1915.

Anamorph: *Piggotia ulmi* (Grev.) Keissler, *Ann.Naturf.Mus.Wien* **1923-1933:** 207, 1933.

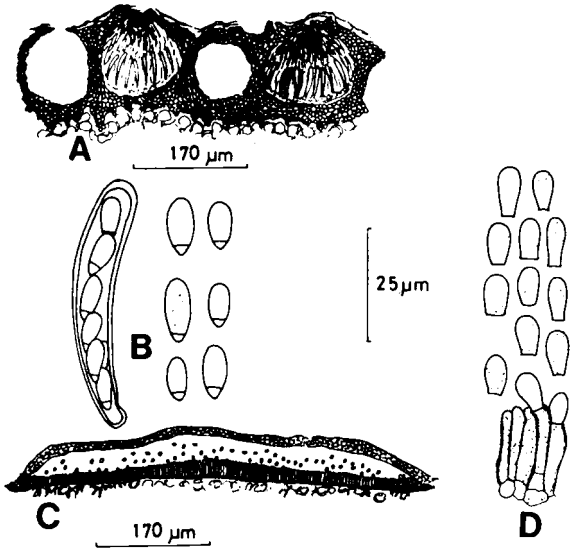


Fig. 363. *Platychora ulmi*. A, v.s. ascostroma; B, ascus and ascospores; C, v.s. conidioma; D, conidiophores and conidia.

Asteroma ulmi Grev., *Fl. Edinb.*: 368, 1824.
Dothidea astroidea Berk., *Engl. Fl.* **5**: 287, 1836.
Piggotia astroidea (Berk.) Berk. & Br., *Ann. Mag. Naturf. Hist. ser.* 2, **7**: 95, 1851.
Basiascella gallarum Bubak, *Ann. Naturf. Hoffmus. Wien* **28**: 216, 1914.

Mycelium immersed, branched, septate, pale brown. Stromata black, subepidermal, gregarious, aggregated, cushion shaped, multilocular, up to 0.5 mm broad, with each locule provided with a papillate ostiole. The stroma is composed of dark brown, thick-walled, globose to angular cells which are almost radially arranged in walls separating the locules. Finally it ruptures the epidermis and appears somewhat tuberculate. Asci narrowly cylindrical, subsessile, 8 spored, 50-60 × 6-8 µm arising from a basal hymenium. Ascospores monostichous, ovoid, 10-12 × 4-5 µm, with a transverse septum near the lower end, hyaline to subhyaline. Pseudoparaphyses filiform, hyaline, branched.

Acervuli single or aggregated into compound fructifications, black, applanate to irregularly pulvinate, up to 1 mm broad, opening by

irregular rupture of the overlying cuticle. Conidiophores branched, pale brown, smooth, cylindrical, septate near the base, formed from the upper cells of the acervulus. Conidiogenous cells holoblastic, with ragged annellations, indeterminate, discrete, cylindrical, pale brown, smooth to verruculose above, 10-12 × 4-4.5 μm. Conidia pale brown, one celled, smooth, cylindrical to almost cuneiform, thin walled, 8-10 × 4.5-5 μm, with an obtuse apex and truncate base.

On *Ulmus,* causing leaf lesions. Europe.

VENTURIA Sacc. nom. cons., *Syll. Fung.* **1:** 586, 1882.

Phaeosphaerella P. Karsten, *Meddel.Soc.Fauna Flora Fenn.* **16:** 28, 1888.
Asterula (Sacc.), Sacc., *Syll. Fung.* **9:** 375, 1891.
Sphaerellopsis Kleb., *Haupt- und Nebenfr. Ascom.:* 168, 1918, non Cooke, 1883.
Spilosticta H. Sydow, *Annls mycol.* **21:** 171, 1923.
Endostigme H. Sydow, *Annls mycol.* **21:** 173, 1923.
Endocoleroa Petrak, *Sydowia* **22:** 388, 1968(1969).

Lectotype sp.: *V. inaequalis* (Cooke) Winter in Thüm., *Mycol.Univ. no.* 261 (in sched.) 1875.

Anamorphs: *Cladosporium* Link: Fr., *Fusicladium* Bonorden, *Pollaccia* Baldacci & Cif., *Spilocaea* Fr.

Pseudothecia immersed in the host substrate, barely to markedly erumpent at the apex, separate or aggregated, sometimes as locules in a stroma or below a blackened clypeus, setose around the ostiole. The wall is composed of somewhat thick-walled pseudoparenchymatic cells on the outside and thin walled cells toward the inside. Asci 8 spored, rarely 4-8 spored, cylindrical, stalked. Ascospores septate above or below the middle, sometimes in the middle, olive green to pale brown or dark brown, smooth or slightly verruculose to echinulate, oblong, elliptic, clavate, ellipsoid to ovoid, not or constricted at the septum, with or without a thin gelatinous sheath. Pseudoparaphyses filiform, septate, branched, hyaline.

Fifty-two species have been recognised in this genus (Sivanesan, 1977) of which fifteen are known to have anamorphs. Parasites of economic importance causing diseases like apple scab, peach scab, poplar shoot blight, poplar scab and cherry scab. The anamorph is usually parasitic and the teleomorph acts as an overwintering structure by developing in fallen overwintered leaves.

Anamorphs: *Cladosporium* Link: Fr.: Colonies velvety, floccose or hairy. Stroma sometimes present. Conidiophores straight or flexuous, mostly unbranched or branched at the apical region forming a stipe and

head, smooth to verrucose, brown. Ramo-conidia often present. Conidiogenous cells polyblastic, integrated, sympodial, cicatrized with usually prominent scars, terminal and intercalary, sometimes discrete. Conidia in chains, simple, dry, acropleurogenous, cylindrical, doliiform, ellipsoidal, fusiform, ovoid, globose or subglobose, often with a distinctly protuberant scar at each end or just at the base, smooth, verruculose or echinulate, olivaceous brown to brown, 0-3 or occasionally more septate.

Fusicladium Bonorden: Mycelium immersed. Stroma often present. Conidiophores simple or occasionally once branched, septate, usually fasciculate, bursting through the cuticle of the host plant. Conidiogenous cells integrated, terminal, polyblastic, sympodial, cicatrized. Scars usually conspicuously thickened, prominent, sometimes situated at the end of short lateral projections, numerous and often crowded, giving a nodular appearance to the conidiophore. Conidia single or occasionally in short chains, dry, variable often tending to be fusiform, truncate at the base and pointed at the apex, 0-3 septate, pale to olivaceous brown, frequently minutely verruculose.

Pollaccia Baldacci & Cif.: Sporodochia scattered sometimes confluent. Mycelium immersed forming radial plates. Stroma present in or below the epidermis. Conidiophores simple, smooth, crowded, hyaline to olive. Conidiogenous cells monoblastic, integrated, determinate or percurrent, cylindrical, ampulliform or doliiform. Conidia solitary, dry, simple, cylindrical, rounded at the apex and truncate at the base, ellipsoidal or obclavate, hyaline or olivaceous, smooth or verrucose, 1-2 septate, often constricted at the apex.

Spilocaea Fr.: Mycelium mostly immersed forming radial plates. Stroma often present. Conidiophores mostly simple, straight or flexuous, brown, smooth. Conidiogenous cells monoblastic, integrated, terminal, percurrent, often with numerous distinct annellations, cylindrical, ampulliform or lageniform. Conidia solitary, dry, acrogenous, simple, usually obpyriform or obclavate, truncate at the base, pale to olivaceous brown, smooth or verruculose, mostly 0-1 septate, sometimes with 2 or more septa, occasionally constricted at the septa.

Key to the Venturia species with anamorphs

Ascospores septate above the middle..... 1

Ascospores septate below the middle..... 6

1. Anamorph *Spilocaea*..... 2

Anamorph *Cladosporium*..... 3

Anamorph *Fusicladium*..... 4

Anamorph *Pollaccia*..... 5

2. Ascospores 13-18 × 6-8 μm, conidia obpyriform or obclavate, 12-30 × 6-10 μm..... *V. inaequalis*

   Ascospores 11-14 × 3-4.5 μm, conidia obclavate-fusiform, 15-25 × 4-6 μm. ..... *V. fraxini*

3. Ascospores constricted at the septum, 11-18 × 5-7 μm, conidia 20-25 × 5-8 μm..... *V. chlorospora*

   Ascospores not or slightly constricted at the septum, 12-15 × 4-5 μm, conidia 15-28 × 4.5-6.5 μm..... *V. acerina*

4. Ascospores 9-11 × 4-5 μm, conidia cylindric-ellipsoidal, 10-18 × 4-6 μm..... *V. syringae*

   Ascospores 12-14 × 4-6 μm, conidia broadly fusoid, 12-25 × 3-5 μm..... ..... *V. crataegi*

5. Ascospores septate just above the middle, 8-14 × 4-6 μm, conidia ellipsoidal to clavate, 15-42 × 6-11 μm..... *V. macularis*

   Ascospores septate in the upper third, 11-14 × 3.5-5 μm, conidia cylindrical to ellipsoidal, 16-23 × 6-9 μm..... *V. saliciperda*

6. Anamorph *Cladosporium*..... 7

   Anamorph *Fusicladium*..... 8

   Anamorph *Pollaccia,* conidia 23-39 × 9-14 μm, ascospores 18-30 × 10-16 μm..... *V. populina*

7. Ascospores monostichous in the ascus, 10-12 × 4-5 μm conidia, ovoid to ellipsoidal, 8-12 × 4-5 μm..... *V. systema-solare*

   Ascospores mono or di-stichous in the ascus, 12-16 × 3-5 μm, conidia cylindric-fusiform or obclavate, 12-30 × 4-6 μm..... *V. carpophila*

8. Conidia broadly fusiform with pointed apex..... 9

   Conidia fusiform, obclavate, clavate or cylindrical with rounded apex.. 10

9. Ascospores 10-14 × 4-6 μm, conidia 16-23 × 5-7 μm..... *V. cerasi*

   Ascospores 14-20 × 4-8 μm, conidia 17-30 × 6-10 μm..... *V. pyrina*

10. Ascospores 10-15 × 4-5 μm, conidia fusiform or cylindrical, 10-15 (25) × 4-5 μm..... *V. asperata*

    Ascospores 10-17 × 4-7 μm, conidia fusiform, obclavate or clavate, 15-24 × 5-9 μm..... *V. ditricha*

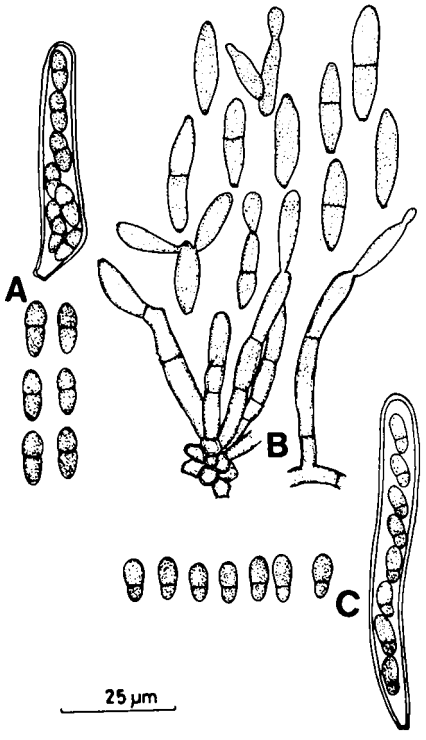


Fig. 364. *Venturia acerina* (type). A, ascus and ascospores; B, conidiophores and conidia. *V. systema-solare*. C, ascus and ascospores.

V. acerina Plakidas ex Barr, *Can. J. Bot.* **46:** 814, 1968 (Fig. 364A,B).

Anamorph: *Cladosporium humile* J.J. Davis, *Trans. Wisc. Acad. Sci. Arts & Lett.* **19:** 702, 1919.

Pseudothecia 70-195 µm broad. Asci 62-75 × 8-10 µm. Ascospores greenish yellow, septate just above the middle, oblong elliptic, smooth, not constricted at the septum, 12-15 × 4-5 µm, with an upper broader cell and a lower narrower cell.

Conidiophores 16-70 × 4.5-6.5 µm. Conidia oblong to cylindrical, 0-1 septate, 15-28 × 4.5-6.5 µm.

On overwintered leaves of *Acer rubrum* U.S.A.

The fungus causes leaf spot of maple.

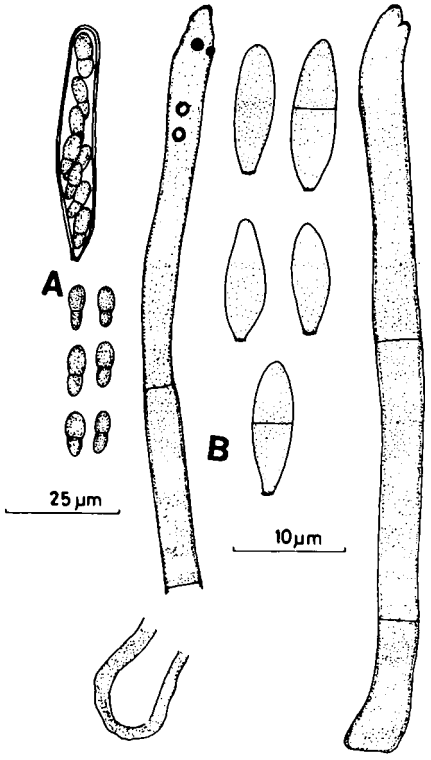


Fig. 365. *Venturia asperata* (type). A, ascus and ascospores; B, conidiophores and conidia.

V. asperata Sivan. & Samuels, *N.Z. Jl Bot.* **13:** 646, 1975 (Fig. 365).

Anamorph: *Fusicladium* sp.

Pseudothecia 120-160 µm broad. Asci 45-65 × 9-12 µm. Ascospores oblong, septate just below the middle, smooth, constricted at the septum, yellowish to pale brown, 10-15 × 4-5 µm, with a broader and rounded upper cell and a tapering lower cell.

Conidial stroma subcuticular. Conidiophores solitary or in fascicles emerging from the stroma, 30-110 × 5 µm. Conidia solitary or in short chains 0-1 septate, narrowly fusiform to cylindrical, smooth to minutely verruculose, yellowish, 10-15(25) × 4-5 µm, with scars at one or both ends.

On leaves of *Malus pumila.* Canada, New Zealand.

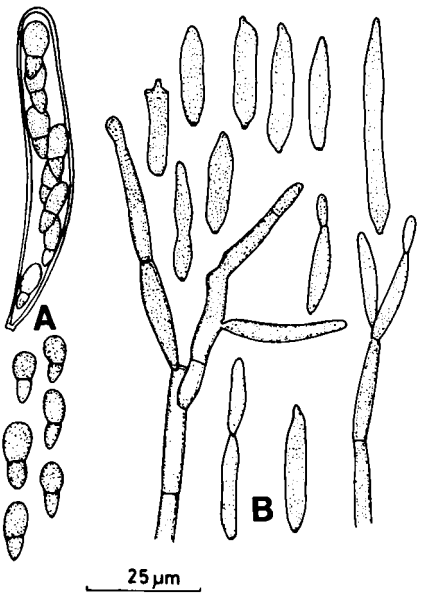


Fig. 366. *Venturia carpophila* (type). A, ascus and ascospores; B, conidiophores and conidia.

V. carpophila E.E. Fisher, *Trans. Br. mycol. Soc.* **44:** 339, 1961 (Fig. 366).

Anamorph: *Cladosporium carpophilum* Thüm., *Osterr. bot. Zeitschr.* **27:** 12, 1877.

Fusicladium carpophilum (Thüm.) Oudem., *Verh. K. Akad. Wet.* **1900:** 388, 1900.
Fusicladium pruni Ducomet, *Thèse Fac. Sci.* Paris: 137, 1907.
Fusicladium amygdali Ducomet, *Annls Ec. natn. Agric. Rennes* **4:** 11, 1911.
Megacladosporium carpophilum (Thüm.) Viennot-Bourg., *Les champignons parasites des plantes cultivees* **1:** 489, 1949.

Pseudothecia 60-160 µm broad. Asci 45-70 × 5-6 µm. Ascospores shortly clavate, constricted at the septum with an upper wider cell and a lower tapered cell, olivaceous, 12-16 × 3-5 µm.

Conidiophores up to 100 µm long, 4-6 µm thick. Conidia simple or in branched chains, cylindrical to fusiform, occasionally obclavate, unicellular, smooth to minutely verruculose, 12-18 (30) × 4-6 µm, with protruding scars at one or both ends.

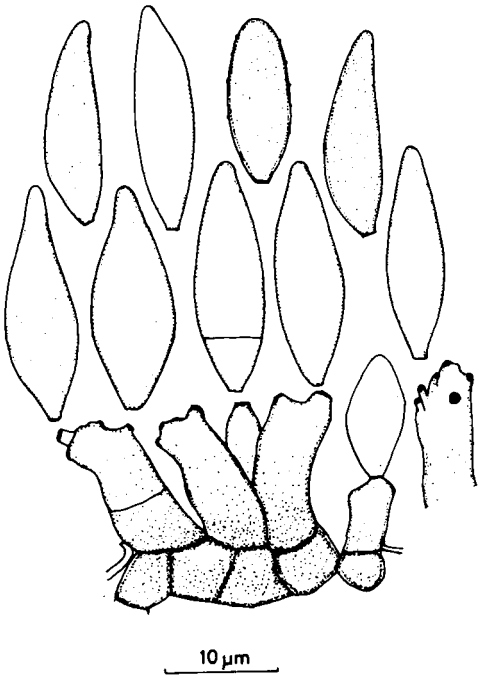


Fig. 367. *Venturia cerasi.* Conidiophores and conidia.

On dead leaves of *Prunus armeniaca* and other *Prunus* spp., Australia, Canada, Ethiopia, U.S.A., Zimbabwe.

The anamorph is the cause of freckle of apricots, plums and almonds and scab of peaches. Sivanesan (1974a) has given a brief description of this species with the disease and its control.

V. cerasi Aderh., *Landw. Jahrb.* **29:** 541, 1900 (Fig. 367).

Venturia chlorospora (Ces.) P. Karsten f. *pruni - cerasi* Sacc., *Michelia* **1:** 382, 1878.

Anamorph: *Fusicladium cerasi* (Rabenh.) Sacc., *Syll. Fung.* **4:** 346, 1886.

Acrosporium cerasi Rabenh. in Braun, *Krankh.pflanz.:* 16, 1854.
Cladosporium cerasi (Rabenh.) Aderh., *Zentr. Bakt.* 2Abt. **7:** 656, 1901.
Megacladosporium cerasi (Rabenh.) Viennot - Bourg., *Les champignons parasites des plantes cultivees* **1:** 537, 1949.

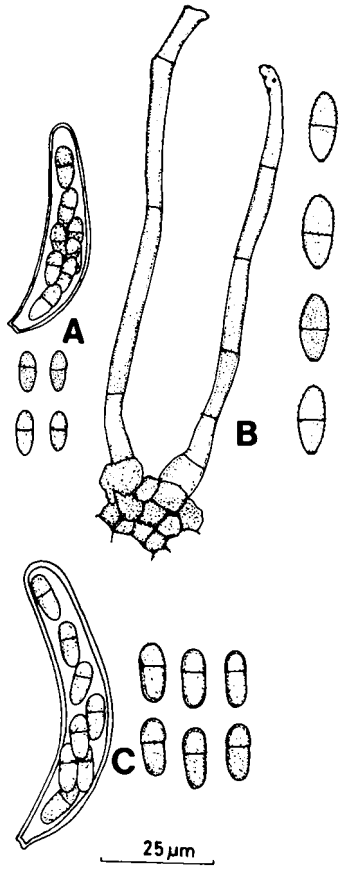


Fig. 368. *Venturia syringae*. A, ascus and ascospores; B, conidiophores and conidia. *V. chlorospora*. C, ascus and ascospores.

Pseudothecia 90-120 µm broad. Asci 50-100 × 8-10 µm. Ascospores pale brown, septate below the middle, constricted at the septum, 10-14 × 4-6 µm.

Conidial stromata subcuticular. Conidiophores fasciculate, short, 0-1 septate, 9-18.5 × 4.5-9 µm, with prominent scars at the ends of short lateral or terminal projections at the apices. Conidia smooth or rugulose, broadly fusoid, pale olivaceous brown to mid brown, 0-1 septate, solitary, sometimes catenulate, 16-23 × 5-7 µm.

On *Prunus cerasus*. Europe, Cyprus. Causes the cherry scab disease. (Sivanesan, & Holliday, CMI Descr. 706, 1981).

V. chlorospora (Ces.) P. Karsten, *Mycol. Fenn.* **2:** 189, 1873 (Fig. 368C).

Sphaeria chlorospora Ces., *Bot. Ztg.* **17:** 296, 1859.
Sphaerella chlorospora (Ces.) Ces. & de Not., *Comm. Soc. Critt. Ital.* **1:** 237, 1863.
Sphaerella canescens P. Karsten, *Mycol. Fenn.* **2:** 190, 1873.
Venturia chlorospora (Ces.) P. Karsten var. *canescens* P. Karsten, *Mycol. Fenn.* **2:** 190, 1873.
Endostigme chlorospora (Ces.) H. Sydow, *Annls mycol.* **21:** 173, 1923.

Anamorph: *Cladosporium* sp.

Pseudothecia 60-120 μm broad. Asci 45-80 × 10-15 μm. Ascospores greenish yellow to pale brown, cylindrical to oblong, septate in or near the upper third, constricted at the septum, 11-18 × 5-7 μm.

Conidia ellipsoidal to cylindrical in unbranched chains, mostly 1 septate, 20-25 × 5-8 μm with scars. Anamorph not observed in nature but formed in culture from ascospore isolates.

On leaves of *Salix* spp., Europe.

V. crataegi Aderh., *Ber. dt bot. Ges.* **20:** 200, 1902 (Fig. 369).

Endostigme crataegi (Aderh.) H. Sydow, *Annls mycol.* **21:** 173, 1923.
Venturia inaequalis (Cooke) Winter f. sp. *crataegi* Menon, *Phytopath. Z.* **27:** 130, 1956.

Anamorph: *Fusicladium crataegi* Aderh., *Ber. dt bot. Ges.* **20:** 200, 1902.

Megacladosporium crataegi (Aderh.) Viennot - Bourg., *Les Champignons parasites des plantes Cultivees* **1:** 539, 1949.

Pseudothecia 90-150 μm broad. Asci 45-55 × 8-11 μm. Ascospores pale brown, oblong elliptic, septate near or in the upper third, constricted at the septum, finely roughened at maturity, 12-14 × 4-6 μm.

Conidial stroma subcuticular. Conidiophores fasciculate, septate, straight or flexuous, 45-80 μm long, cicatrized, denticulate. Conidia broadly fusoid, pale olivaceous brown, 1-2 septate, 12-16 (25) × 3-5 μm, smooth to verruculose.

On *Crataegus oxyacantha*. Europe.

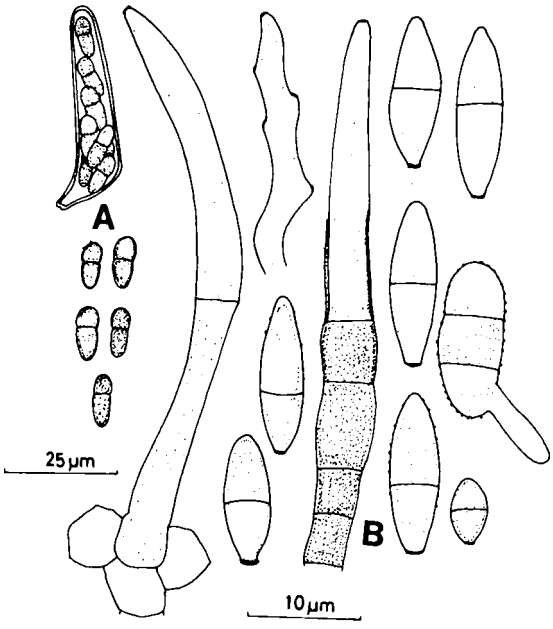


Fig. 369. *Venturia crataegi.* A, ascus and ascospores; B, conidiophores and conidia.

V. ditricha (Fr.) P. Karsten, *Mycol. Fenn.* **2:** 188, 1873 (Fig. 370).

Sphaeria ditricha Fr., *Syst. mycol.* **2:** 515, 1823.
Vermicularia ditricha (Fr.) Fr., *Summa veg. Scand.:* 420, 1849.
Sphaerella ditricha (Fr.) Auersw., *Bot. Ztg.* **24:** 300, 1866 (pro parte).
Sphaerella ditricha (Fr.) Fuckel, *Symbol. mycol.:* 100, 1870.
Venturia maculans Peck, *A. Rep. N.Y. St. Mus.* **28:** 81, 1874.
Venturia ditricha (Fr.) P. Karsten var. *major* Peck in Thüm. *Fl.* **36:** 173, 1877.
Endostigme ditricha (Fr.) H. Sydow, *Annls mycol.* **21:** 173, 1923.

Anamorph: *Fusicladium betulae* (Rob.) Aderh., *Centblt. Bakt. Parasitkde* **2:** 57, 1896.

Asteroma betulae Rob. in Desm., *Ann. Sci. nat. Bot.* **19:** 349, 1843.

Pseudothecia in dead leaves in spring and summer, 80-150 µm broad. Asci 50-68 × 9-14 µm. Ascospores olive green, greenish yellow to olivaceous brown, ovoid to clavate, septate below the middle or near the lower third, constricted at the septum, 10-17 × 4-7 µm.

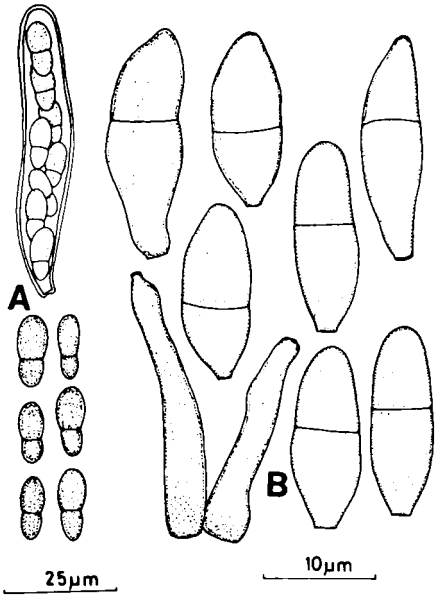


Fig. 370. *Venturia ditricha* (type). A, ascus and ascospores; B, conidiophores and conidia.

Conidial state parasitic on living leaves. Stroma subcuticular. Conidiophores fasciculate on the stroma, 30-70 µm long, cicatrized. Conidia pale olivaceous, more or less fusoid tending to be obclavate or clavate, verruculose, 1 septate, rarely 2 septate, often constricted at the septum, 15-24 × 5-9 µm.

On *Betula* spp. Europe.

V. fraxini (Fr.) Aderh., *Hewigia* **36:** 83, 1897 (Fig. 371).

Dothidea fraxini Fr., *Syst. mycol.* **2:** 561, 1823.
Endostigme fraxini (Aderh.) H. Sydow, *Annls mycol.* **21:** 173, 1923.
Spilosticta fraxini (Aderh.) Petrak, *Annls mycol.* **25:** 366, 1927.
Venturia ditricha (Fr.) P. Karsten var. *fraxinicola* Rehm, Ascomyceten no. 792, *Syll. Fung.* **9:** 690, 1891.

Anamorph: *Spilocaea fraxini* (Aderh.) Sivan. *Bibl.Mycol.* **59:** 65, 1977.

Fusicladium fraxini Aderh., *Hedwigia* **36:** 83, 1897 (as '*F. tremulae*').

Pseudothecia 80-100 µm broad. Asci 40-55 × 9-12 µm. Ascospores

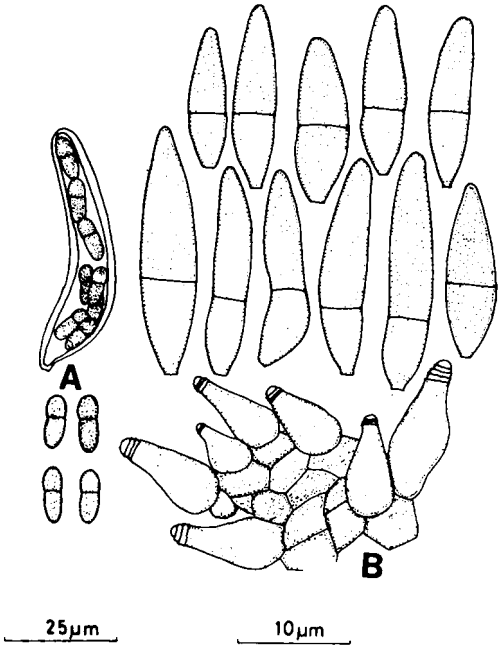


Fig. 371. *Venturia fraxini.* A, ascus and ascospores; B, conidiophores and conidia.

septate above the middle, pale brown, constricted at the septum, 11-14 × 3-4.5 µm.

Conidial state parasitic on leaves in summer and autumn. Stroma subcuticular. Conidiophores fasciculate on the stroma up to 20 µm long. Conidia pale olivaceous, obclavate fusoid, 0-1 septate, rarely 3 septate, not or slightly constricted at the septa, 15-25 × 4-6 µm, formed singly at the apex of the conidiophore and then successively by proliferation resulting in distinct annellations in the conidiophore.

On petioles and leaves of *Fraxinus,* Europe. The fungus causes withering and premature leaf fall in ash.

V. inaequalis (Cooke) Winter in Thüm., *Mycol. Univ. no.* 261 (in sched.) 1875 (Fig. 372).

Sphaerella inequalis Cooke, *J.Bot.Lond.* **4:** 248, 1866.
Sphaeria cinerascens Fuckel, *Fungi Rhenani* no. 824, 1863, non Schwein. 1832.
Sphaerella cinerascens (Fuckel) Fleisch., *Rabenh. Fungi Europaei* no. 845, 1865.

Sphaerella cinerascens Fuckel, *Symbol. mycol.:* 103, 1870.
Didymosphaeria inaequalis (Cooke) Niessl, Rabenh. *Fungi Europaei* no. 2663, 1881.
Venturia chlorospora (Ces.) P. Karsten f. *mali* Aderh., *Ber.dt bot. Ges.* **12:** 338, 1894.
Endostigme inaequalis (Cooke) H. Sydow, *Annls mycol.* **21:** 173, 1923.
Phaeosphaerella berolinensis Kirschst., *Krypt. Fl.Mark Brandenb.* **7:** 419, 1938.
Spilosticta inaequalis (Cooke) Petrak, *Annls mycol.* **38:** 193, 1940.
Endostigme cinerascens (Fuckel) Jørst., *Nytt.Mag.nat.urvid.* **84:** 252, 1944.
Spilosticta cinerascens (Fuckel) Petrak, *Sydowia* **1:** 197, 1947.
Venturia inaequalis (Cooke) Winter f.sp.*mali* Menon, *Phytopath.Z* **27:** 129, 1956.

Anamorph: *Spilocaea pomi* Fr., *Nov.Fl.Suec.:* 79, 1819; *Syst. veg.:* 198, 1825.

Spilocaea pomi Fr.: Fr., *Syst. mycol.* **3:** 504, 1832.
Helminthosporium pyrorum Lib., *Pl.Crypt.Ard.* 2: No. 188, 1832 (pro parte).
Cladosporium dendriticum Wallr., *Fl.Crypt.Germ.* **2:** 169, 1833.
Fusicladium dendriticum (Wallr.) Fuckel, *Symb.mycol.:* 357, 1870.
Napicladium sorauerí Thüm., *Mycol.Univ.*no. 91, 1875.
Fusicladium dendriticum (Wallr.) Fuckel var. *sorauerí* (Thüm.) Sacc., *Syll. Fung.* **4:** 346, 1886.
Fusicladium pomi (Fr.) Lind, *Danish Fungi:* 521, 1913.
Cladosporium mali Dearn. & Foster, *Can.J.Bot.* **16:** 274, 1938.

Pseudothecia 120-225 μm broad. Asci 60-70 × 7-12 μm. Ascospores olivaceous brown, septate in the upper third, 13-18 × 6-8 μm.

Mycelium forms radiating plates, immersed. Conidiophores up to 90 μm long, 5-6 μm thick. Stroma often formed. Conidia obpyriform to obclavate, pale to mid olivaceous brown, smooth, 0-1 septate, 12-30 × 6-10 μm formed singly at the apex of the conidiophore and then successively by proliferation resulting in distinct annellations in the conidiophore.

On *Cotoneaster integerrima, Malus, Pyracantha, Pyrus* and *Sorbus.* Europe, Australia, Canada, India, Iraq, Ethiopia, Libya, Pakistan, U.S.A, Zimbabwe.

This species causes the well known scab or black spot of apple. Sivanesan & Waller (1974a) have briefly described the morphology, disease and control of this fungus.

V. macularis (Fr.) E. Müller & von Arx, *Ber.Schweiz bot. Ges.* **60:** 366, 1950 (Fig. 373A,B).

Sphaeria macularis Fr., *Syst. mycol.* **2:** 502, 1823.

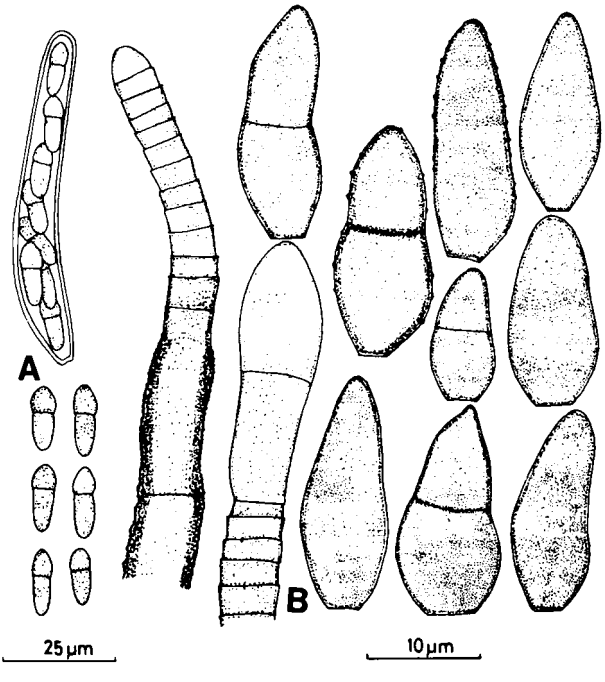


Fig. 372. *Venturia inaequalis.* A, ascus and ascospores; B, conidiophores and conidia.

Sphaerella major Auersw. in Gonnerm. & Rabenh., *Mycol.Europ.* 5/6: 8, 1869.
Sphaerella macularis (Fr.) Auersw. in Gonnerm. & Rabenh., *Mycol. Europ.* 5/6: 9, 1869.
Sphaerella macularis P. Karsten, *Mycol. Fenn.* **2:** 174, 1873.
Sphaerella orbicularis Peck, *Bull.N.Y.St.Mus.* **28:** 8, 1879.
Sphaerella maculosa Sacc., *Syll. Fung.* **1:** 487, 1882.
Phaeosphaerella maculosa (Sacc.) P. Karsten, *Meddn. Soc. Fauna Flora Fenn.* **16:** 28, 1888.
Mycosphaerella macularis (Fr.) Schroeter in Cohn, *Krypt.-Fl. Schlesien* **3:** 335, 1894.
Didymosphaeria populifolia Ell. & Ev., *Proc. Acad.nat.Sci.Philad.* **46:** 335, 1894.
Venturia tremulae Aderh., *Hedwigia* **36:** 81, 1897.
Microthelia populifolia (Ell. & Ev.) Kuntze, *Rev. Gen.Pl.* **3:** 498, 1898.
Phaeosphaerella macularis (Fr.) Trav., *Atti Accad.scient.venetotrent.-istriana* **5:** 8, 1912.
Mycosphaerella orbicularis (Peck) House, *Bull.N.Y.St.Mus.* **233-234:** 28, 1921.
Endostigme tremulae (Aderh.) H. Sydow, *Annls mycol.* **21:** 173, 1923.
Venturia radiosa Ferdinandsen & Jorgenson, *Skootraeenes Sygdomme* **1:** 125, 1938.
Spilosticta macularis (Fr.) Petrak, *Annls mycol.* **38:** 250, 1940.

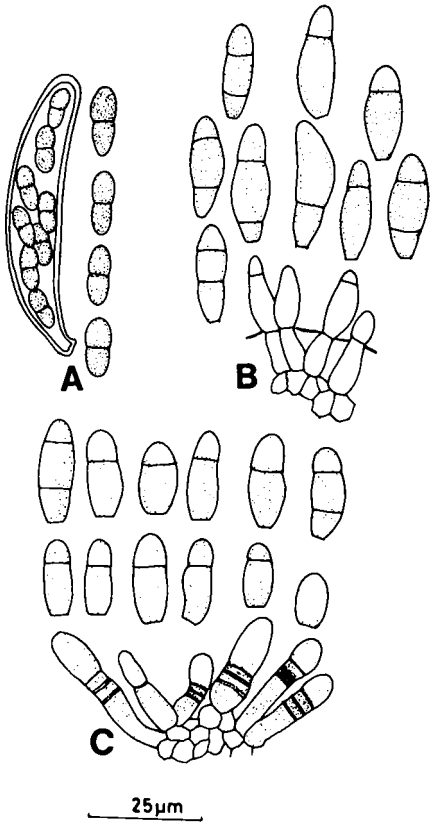


Fig. 373. *Venturia macularis*. A, ascus and ascospores; B, conidiophores and conidia. *V. saliciperda*. C, conidiophores and conidia.

Anamorph: *Pollaccia radiosa* (Lib.) Baldacci & Cif., *Atti Ist. bot. Univ.Lab.crittogam. Pavia* **10:** 55-72, 1937.

Oidium radiosum Lib., *Pl.Crypt. Arduennae* no. 285, 1834.
Cladosporium ramulosum Rob. in Desm., *Ann.Sci.nat.* **18:** 361, 1852.
Cladosporium asteroma Fuckel, *Symb.mycol.*: 355, 1869.
Fusicladium tremulae Frank, *Hedwigia* **22**: 127, 1883.
Cladosporium asteroma Fuckel var. *microsporum* Sacc., *Syll.Fung.* **4:** 357, 1886.
Napicladium tremulae (Frank) Sacc., *Syll.Fung.* **4:** 482, 1886.
Clasterosporium populi Ell. & Ev., *J. Mycol.* **7:** 134, 1892.
Stigmina populi (Ell. & Ev.) Pounds & Clem., *Bull.Minn.geo.nat.His.Surv. bot.* ser. **9:** 662, 1896.
Napicladium asteroma (Fuckel) Allesch., *Ber.bayer.bot.Ges.* **5:** 25, 1897.

Fusicladium asteroma (Fuckel) Sacc. & Cav., *Nuovo. G.bot.ital.* **7:** 307, 1900.
Fusicladium radiosum (Lib.) Lind, *Annls mycol.* **3:** 430, 1905.
Stigmina populi (Ell. & Ev.) Peck, *Bull.N.Y.St.Mus.* **157:** 34, 1912.
Fusariella populi Garbowski, *Bull.Soc.mycol.Fr.* **33:** 89, 1917.
Stigmina radiosa (Lib.) Goid., *Annali Bot.* **21:** 11, 1936.

Pseudothecia 80-140 μm broad. Asci 8 spored, rarely 2-4 spored, 40-65 × 10-12 μm. Ascospores olivaceous to brown, ellipsoidal, clavate or more or less obpyriform, septate just above the middle, constricted at the septum smooth to finely roughened, 8-14 × 4-6 μm, with or without a mucilaginous sheath.

Sporodochia amphigenous. Mycelium and stroma immersed. Conidiophores solitary or in groups from the stroma, 9-17 × 3-7 μm. Conidia solitary, dry, simple, ellipsoidal to clavate, smooth, 1-2 septate, occasionally constricted at the septa, often with a minute frill at the base, 15-42 × 6-11 μm.

On *Populus* spp. Canada, Europe, U.S.A. Sivanesan (1974b) has given a brief account of the morphology, pathogenicity and control of this species which causes the shoot tip or scab of poplars of sections Leuca and Aigeiros.

V. populina (Vuill.) Fabric. in Hollrungs, *Jber.Neu.Leist.Geb.Pfl. Krankh.* **5:** 282, 1902 (Fig. 374).

Didymosphaeria populina Vuill., *C.R.Ac.France* **108:** 632, 1899.
Pollaccia balsamiferae (J.J. Davis) Morelet, *Bull.Soc.sci.nat. Archéol. Toulon* **4:** 3, 1972.

Anamorph: *Pollaccia balsamiferae* (J.J. Davis) Morelet, *Bull.Soc.sci. nat. Archéol. Toulon* **4:** 3, 1972.

Fusicladium radiosum (Lib.) Lind var. *balsamiferae* J.J. Davis, *Trans. Wisc. Acad.Sci. Arts Lett.* **20:** 402, 1922.
Pollaccia elegans Servazzi, *Boli.Lab.sper.Oss.Fitopat.* **15:** 18, 1939.

Pseudothecia 160-220 μm broad. Asci 8 spored, rarely 4 spored, 90-125 × 18-26 μm. Ascospores pale olivaceous brown, septate in or near the lower third, broadly elliptical, constricted at the septum, smooth, 18-30 × 10-16 μm.

Sporodochia amphigenous. Mycelium and stromata immersed. Conidiophores solitary or in groups from the stromata, 10-16 × 2-5 μm. Conidia ellipsoidal to broadly fusoid, olivaceous brown, smooth, 2 septate with equidistant septa dividing a large central cell from two

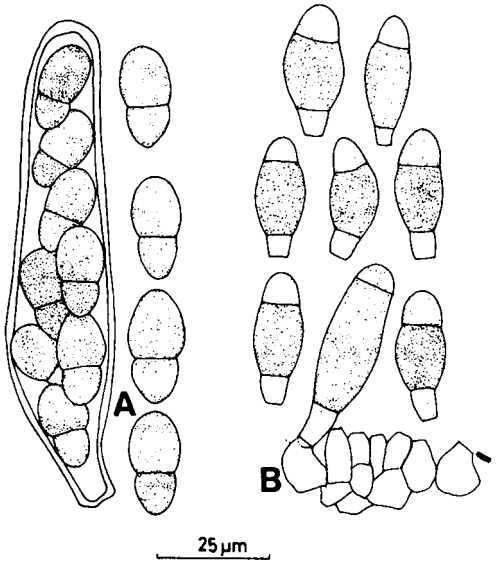


Fig. 374. *Venturia populina*. A, ascus and ascospores; B, conidiophores and conidia.

small end cells, rarely 0-1-3 septate, slightly constricted at the septa, straight or curved, 23-39 × 9-14 µm.

On *Populus* spp. Canada, Europe, U.S.A. This species causes leaf and shoot blight or die-back of poplars belonging to sections Tacamahaca and Aigeiros. Sivanesan (1976b) has given a brief account of the morphology, pathogenicity and control of this species.

V. pyrina Aderh. (as '*pirina*'), *Landw.Jbr.* **25:** 875, 1896. (Fig. 375).

Venturia ditricha (Fr.) P. Karsten f. *piri* Bref., *Unters.Ges.Mykol.* **10:** 221, 1891.
Endostigme pyrina (Aderh.) H. Sydow, *Annls mycol.* **21:** 173, 1923.
Venturia nashicola Tanaka & Yamamoto, *Ann.Phytopath.Soc.Japan* **29:** 128-136, 1964.

Anamorph: *Fusicladium pyrorum* (Lib.) Fuckel, *Symb.mycol.:* 357, 1870 (ex errore sub '*Fusicladium pyrinum*').

Helminthosporium pyrorum Lib. (pro parte), *Plantae crypt.Arduennae Fas.* 2, No. 188, 1832.

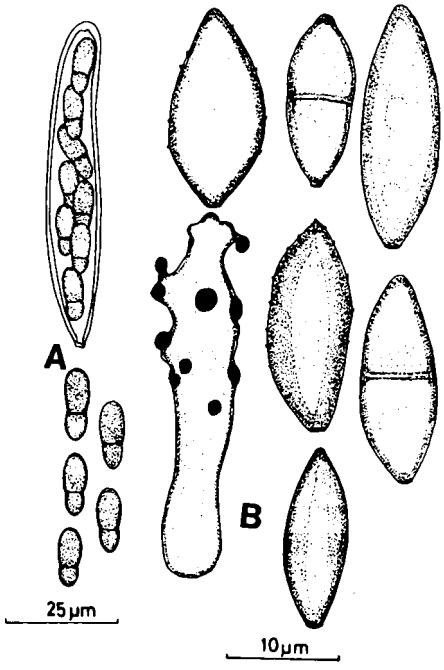


Fig. 375. *Venturia pyrina*. A, ascus and ascospores; B, conidiophore and conidia.

Arthrinium pyrinum Wallr., *Fl.Crypt.Ger.* **2:** 163, 1833.
Fusidium pyrinum Corda, *Icon.Fung.* **1:** 3, 1837.
Fusicladium virescens Bon., *Handb. Mykol.:* 80, 1851.
Megacladosporium pyrorum (Lib.) Viennot-Bourgin, *Les champignons parasites des plantes cultivees* **1:** 489, 1949 (ex errore sub '*Megacladosporium pirinum*').

Pseudothecia 90-180 µm broad. Asci 60-75 × 9-12 µm. Ascospores olivaceous, septate in the lower third, oblong, consticted at the septum, smooth, 14-20 × 4-8 µm.

Stroma present. Conidiophores up to 90 µm long, 4-9 µm thick. Conidia broadly fusiform, mid pale olivaceous brown, smooth, rugulose or verruculose, 0-1 septate, 17-30 × 6-10 µm.

On *Eriobotrys japonica, Pyrus* spp. Australia, Canada, India, Europe, New Zealand, U.S.A. This fungus causes the well known scab or black spot of pear. A brief account of the morphology, pathogenicity and control of this fungus has been given by Sivanesan & Waller (1974b).

V. saliciperda Nüesch, *Phytopath. Z.* **39:** 350, 1960 (Fig. 373C).

Anamorph: *Pollaccia saliciperda* (Allesch. & Tub.) von Arx, *Tidschr.Pl Ziekt.* **63:** 233, 1957.

Septogloeum saliciperdum Allesch. & Tub. in Allesch. & Schnabl., *Fungi Bavarici* No. 485, 1895.
Fusicladium saliciperdum (Allesch. & Tub.) Tubeuf, *Arb.biol.Bund Anst. Land- u. Forstw.* **2:** 568, 1902.
Fusicladium saliciperdum (Allesch. & Tub.) Lind, *Annls mycol.* **3:** 30, 1905.

Pseudothecia 80-120 μm broad. Asci 35-55 × 8-12 μm. Ascospores yellowish green, narrowly elliptical, septate in the upper third, constricted at the septum, 11-14 × 3.5-5 μm.

Conidial colonies mostly hypophyllous along the midrib and veins of young leaves and on shoots forming large brown irregular spots and dieback of shoots. Conidiophores arise from a small subcuticular or epidermal stroma, 8-15 × 5-8 μm. Conidia greenish brown to olivaceous, cylindrical to ellipsoidal, 1-2 septate, 16-23 × 6-9 μm.

On *Salix* spp. Canada, Europe. The anamorph is a primary and very aggressive parasite causing black lesions on twigs and leaves (willow scab). A brief account of the morphology, pathogenicity and control has been given by Sivanesan (1976a).

V. syringae (H. Sydow) Barr, *Can.J.Bot.* **46:** 815, 1968 (Fig. 368A,B).

Phaeosphaerella syringae H. Sydow, *Annls mycol.* **21:** 145, 1923.
Spilosticta syringae (H. Sydow) Petrak, *Hedwigia* **65:** 241, 1925.
Venturia syringina Kirschst., *Hedwigia* **80:** 125, 1941.

Anamorph: *Fusicladium* sp.

Pseudothecia 50-110 × 60-90 μm. Asci 35-50 × 8-10 μm. Ascospores greenish to yellowish brown, elliptical to clavate, septate just above the middle, slightly constricted at the septum, 9-11 × 4-5 μm.

Conidiophores mainly hypophyllous on a stroma in living leaves, 25-60 × 5-6 μm. Conidia brown, verruculose, cylindric-ellipsoidal, 0-1 septate, 10-18 × 4-6 μm.

On leaves of *Syringa vulgaris*. Germany.

V. systema-solare (Fuckel) Winter, Rabh. *Kryptogamen-fl.* **1:** 437, 1887 (Fig. 364C).

Sphaeria systema-solare Fuckel, *Symb.mycol.:* 111, 1870.
Depazea systema-solare (Fuckel) Crie, *Ann.Sci.Nat.Bot.* **7:** 42, 1878.
Venturia clintonii Peck, *Rep.N.Y.St.Mus.* **28:** 82, 1879.
Laestadia systema-solare (Fuckel) Sacc., *Syll.Fung.* **1:** 423, 1882.
Endostigme systema-solare (Fuckel) Munk, *Dansk Bot.Arkiv* **15:** 104, 1953.

Anamorph: *Cladosporium* sp. (Thirumalacher & Whitehead, 1951; Müller, 1958).

Pseudothecia 90-120 μm broad. Asci 60-75 × 5-7 μm. Ascospores uniseriate in the ascus, broadly clavate, septate in or near the lower third, somewhat constricted at the septum, olive green, 10-12 × 4-5 μm.

Conidia single or in short chains, olive green, 0-1 septate, ovoid to elliptical, 8-12 × 4-5 μm.

On fallen leaven of *Cornus circinata* and *C. sanguinea.* U.S.A, Switzerland.

XENOMERIS H. Sydow in H. Sydow & Werdermann, *Annls. mycol.* **22:** 185, 1924.

Type sp.: *X. nicholsonii* (Cooke) Petrak, *Engler Bot. Jahrb.* **142:** 136, 1929 (= *X. pruni* H. Sydow).

Only one species known with *Sclerophoma* and *Hormonema* anamorphs.

X. abietis Barr, *Can.J.Bot.* **46:** 842, 1968 (Fig. 376).

Anamorphs: *Sclerophoma xenomeria* Funk, *Eur.J.For.Path.* **10:** 54, 1980 and a *Hormonema* state in culture.

Pseudothecia clustered on a stroma on leaf scars, twigs or in bark. Stromata stalked, brown to black, superficial, up to 1 mm broad, composed of dark brown polygonal cells. Hypostroma in host tissues. Pseudothecia globose, collapsing to cupulate, up to 200 μm broad, dark brown, ostiolate with a wall 20-30 μm thick composed of almost similar cells like that of the stroma but with the cells towards the interior more or less rectangular and thin-walled. Asci short stalked, 8 spored, oblong to saccate, 33-55 × 11-16 μm. Ascospores greenish to rarely pale brown, smooth, septate just below the middle, 11-17 (20) × 4-6 μm.

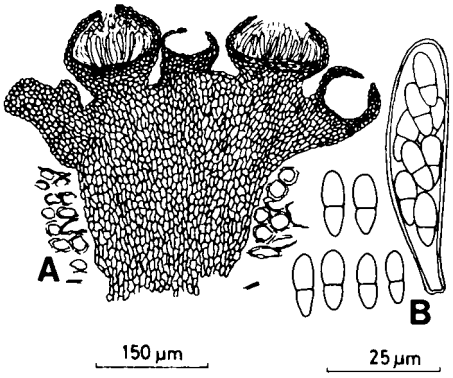


Fig. 376. *Xenomeris abietis.* A, v.s. ascostroma; B, ascus and ascospores.

Pycnidia erumpent, sessile, shiny black, disciform to subglobose, sometimes multilobed, up to 500 µm broad. The pycnidial wall is composed of dark brown pseudoparenchymatous cells. Conidiogenous cells phialidic formed from the cells lining the cavity of the pycnidium, globose to ampulliform. Conidia hyaline, unicellular, ellipsoidal, 8-10 × 4-5 µm, 1-2 guttulate.

In culture the ascospores and conidia germinate to form large, thick-walled, dark cells that bud numerous, hyaline, one celled, guttulate, broadly ellipsoidal to oblong, 11-17 × 5-7 µm, *Hormonema* conidia (Funk & Shoemaker, 1971). The genetic connection between the teleomorph and the anamorph (*Sclerophoma*) has been proved by plating ascospores and conidia on malt agar and producing identical *Hormonema* colonies (Funk, 1980).

On *Abies grandis,* U.S.A, *Pseudotsuga menziesii* and *Tsuga heterophylla,* British Columbia, associated with die-back.

List of Connexions

Teleomorph	Anamorph
Abrothallus	Vouaxiomyces
Acantharia	Fusicladium, Stigmina
Acrogenotheca	Pycnidial (spermatial)
Acrospermum	Dactylella-like
Aithaloderma	Pycnidial
Alina	Tretospora
Asteromassaria	Scolicosporium
Allosoma	Periconiella
Anthracostroma	Camarosporula
Apiosporina	Cladosporium, Fusicladium
Asterina	Clasterosporium, Asterostomella
Asterodothis	Clasterosporium
Atopospora	Didymochora
Balladynopsis	Tretospora
Batistinula	Triposporium
Botryosphaeria	Botryodiplodia, Diplodia, Dothiorella, Macrophoma, Sphaeropsis
Brooksia	Hiospora
Capnodium	Fumagospora, Phaeoxyphiella, Scolecoxyphium
Chevalieropsis	*Stauroconidial*
Cochliobolus	Curvularia, Drechslera
Cucurbidothis	Coniothyrium
Cucurbitaria	Camarosporium, Dichomera, Diplodia, Pyrenochaeta
Clypeolella	Mitteriella, Sarcinella, Questieriella
Cymadothea	Polythrincium
Dennisiella	Microxiphium
Dictyotrichiella	Exophiala
Didymella	Ascochyta, Phoma
Didymosphaeria	Ascochyta, Dendrophoma, Fusicladiella-like
Discosphaerina	Sarcophoma, Selenophoma, Kabatia
Dothiora	Dothichiza
Elsinoe	Sphaceloma
Eudarluca	Sphaerellopsis

Euantennaria	Hormisciomyces, Antennatula
Eupelte	Sporidesmium
Eutryblidiella	Pycnidial
Farlowiella	Acrogenospora
Gibbera	Stigmina, Virgariella
Guignardia	Phyllosticta
Herpotrichia	Pyrenochaeta
Hysterium	Coniosporium, pycnidial
Keissleriella	Ascochyta, Dendrophoma
Leptosphaeria	Coniothyrium, Diplodia, Phaeoseptoria, Phoma, Scolecosporiella, Septoria, Stagonospora
Leptoguignardia	Dothichiza-like
Massarina	Coniothyrium, Ceratophoma, Diplodia, Microsphaeropsis, Anguillospora, Clavariopsis, Pyricularia
Maurodothina	Pirozynskia
Microthelia	Dendryphiopsis
Melanodothis	Ramularia-like
Melanomma	Aposphaeria, Pseudospiropes
Meliolina	Phialophora-like
Metacapnodium	Capnophialophora, Capnobotrys or Capnocybe, Hormiokrypsis or Capnosporium,? Torulopsiella
Microcyclus	Fusicladium, Pazschkeella
Microthelia	Dendryphiopsis
Morenoina	Sirothyriella
Mycosphaerella	Ascochyta, Asteromella, Cercospora, Cercoseptoria, Cercosporella, Cercosporidium, Cladosporium, Colletogloeum, Fusicladiella, Miuraea, Phaeoisariopsis, Phloeospora, Paracercospora, Phoma, Pseudocercospora, Pseudocercosporella, Ovularia, Ramularia, Septoria, Stenella, Stigmina
Mytilinidion	Aposphaeria, Pyrenochaeta, Sclerochaeta, Septonema
Ophiobolus	Scolecosporiella
Ophiocapnocoma	Capnophialophora, Hormiokrypsis
Ophioparodia	Septoidium
Otthia	Diplodia
Paraphaeosphaeria	Coniothyrium

Perisporiopsis	Septoidium
Phragmocapnias	Conidiocarpus
Pilgeriella	Septoidium
Placosoma	Clasterosporium-like
Pleomassaria	Prosthemium, Shearia
Pleospora	Alternaria, Stemphylium, Phoma, Diplodia, Microdiplodia
Platychora	Piggotia
Podonectria	Tetracrium, Tetranacrium
Pringsheimia	Dothichiza
Pyrenophora	Drechslera
Rhytidenglerula	Capnodiastrum
Rhytidiella	Phaeoseptoria, Pseudosporella
Schiffnerula	Mitteriella, Sarcinella, Questieriella
Scirrhia	Lecanosticta, Dothistroma
Seuratia	Atichia
Sydowia	Dothichiza, Sclerophoma
Scorias	Conidiocarpus, Polychaeton, Scolecoxyphium
Setosphaeria	Drechslera (= Exserohilum)
Sphaerulina	Cercospora, Cercosporella, Septoria
Strigopodia	Antennatula, Capnophialophora
Splanchnonema	Stegonsporium
Thaxteriella	Helicoma
Thaxteriellopsis	Moorella, Xenosporium
Thyridaria	Cyclothyrium
Trichothyrium	Isthmospora, Hansfordiella
Tubeufia	Helicosporium, Monodictys-like, Asteromella-like, *Spermatial pycnidia*
Uleothyrium	Septothyrella
Venturia	Cladosporium, Fusicladium, Pollaccia, Spilocaea
Xenomeris	Sclerophoma (also Hormonema in culture)
Zeuctomorpha	Acroconidiellina

Anamorph(Hyphomycete)	**Teleomorph**
Acroconidiellina	Zeuctomorpha
Acrogenospora	Farlowiella
Alternaria	Pleospora
Anguillospora	Massarina
Antennatula	Euantennaria, Strigopodia
Atichia	Seuratia
Capnobotrys	Metacapnodium
Capnocybe	Metacapnodium
Capnophialophora	Metacapnodium, Ophiocapnocoma, Strigopodia
Capnosporium	Metacapnodium
Cercoseptoria	Mycosphaerella
Cercospora	Sphaerulina, Mycosphaerella
Cercosporella	Mycosphaerella, Sphaerulina
Cercosporidium	Mycosphaerella
Cladosporium	Apiosporina, Mycosphaerella, Venturia
Clasterosporium	Asterina, Asterodothis
Clavariopsis	Massarina
Coniosporium	Hysterium
Curvularia	Cochliobolus
Dendryphiopsis	Microthelia
Drechslera	Cochliobolus, Pyrenophora, Setosphaeria
Exophiala	Dictyotrichiella
Fusicladiella	Didymosphaeria, Mycosphaerella
Fusicladium	Acantharia, Apiosporina, Microcyclus, Venturia
Hansfordiella	Trichothyrium
Helicoma	Thaxteriella
Helicosporium	Tubeufia
Hiospora	Brooksia
Hormiokrypsis	Metacapnodium, Ophiocapnocoma
Hormisciomyces	Euantennaria
Isthmospora	Trichothyrium
Mitteriella	Clypeolella, Schiffnerula, Yamamotoa
Miuraea	Mycosphaerella
Monodictys-like	Tubeufia
Moorella	Thaxteriellopsis

Ovularia	Mycosphaerella
Paracercospora	Mycosphaerella
Periconia	Didymosphaeria
Periconiella	Allosoma
Phaeoisariopsis	Mycosphaerella
Pirozynskia	Maurodothina
Pollaccia	Venturia
Polythrincium	Cymadothea
Pseudocercospora	Mycosphaerella
Pseudocercosporella	Mycosphaerella
Pseudospiropes	Melanomma
Pyricularia	Massarina
Questieriella	Clypeolella, Schiffnerula
Ramularia	Mycosphaerella, Melanodothis
Sarcinella	Clypeolella, Schiffnerula
Septoidium	Ophioparodia, Perisporiopsis, Pilgeriella
Septonema	Hysterium, Mytilinidion
Spilocaea	Venturia
Sporidesmium	Eupelte
Stemphylium	Pleospora
Stenella	Mycosphaerella
Stigmina	Acantharia, Gibbera, Mycosphaerella
Tretospora	Alina, Balladynopsis
Tetracrium	Podonectria
Tetranacrium	Podonectria
Triposporium	Batistinula
Virgariella	Gibbera
Xenosporium	Thaxteriellopsis

Anamorph (Coelomycete)	**Teleomorph**
Aposphaeria	Melanomma
Ascochyta	Didymosphaeria, Keissleriella, Mycosphaerella
Asteromella	Mycosphaerella
Asterostomella	Asterina
Botryodiplodia	Botryosphaeria
Camarosporium	Cucurbitaria, Leptosphaeria
Camarosporula	Anthracostroma
Capnodiastrum	Rhytidenglerula
Ceratophoma	Massarina
Colletogloeum	Mycosphaerella
Conidiocarpus	Phragmocapnias, Scorias
Coniothyrium	Paraphaeosphaeria, Cucurbidothis, Leptosphaeria, Massarina
Cyclothyrium	Thyridaria
Dendrophoma	Didymosphaeria, Keissleriella
Dichomera	Cucurbitaria
Didymochora	Atopospora
Diplodia	Botryosphaeria, Cucurbitaria, Massarina, Otthia, Pleospora
Diplodina	Leptosphaeria
Dothiorella	Botryosphaeria
Dothichiza	Dothiora, Pringsheimia, Sydowia
Dothistroma	Scirrhia
Fumagospora	Capnodium
Kabatia	Discosphaerina
Lecanosticta	Scirrhia
Macrophoma	Botryosphaeria
Microdiplodia	Pleospora
Microsphaeropsis	Massarina
Microxiphium	Dennisiella
Pazschkeella	Microcyclus
Phaeoseptoria	Leptosphaeria, Rhytidiella
Phaeoxyphiella	Capnodium
Phloeospora	Mycosphaerella
Phoma	Didymella, Leptosphaeria, Mycosphaerella, Pleospora
Piggotia	Platychora

Phyllosticta	Guignardia
Polychaeton	Scorias
Prosthemium	Pleomassaria
Pseudosporella	Rhytidiella
Pyrenochaeta	Cucurbitaria, Herpotrichia, Mytilinidion
Sarcophoma	Discosphaerina
Sclerochaeta	Mytilinidion
Sclerophoma	Sydowia, Xenomeris
Scolecosporiella	Leptosphaeria, Ophiobolus
Scolecoxyphium	Capnodium, Scorias
Scolicosporium	Asteromassaria
Selenophoma	Discosphaerina
Septoria	Leptosphaeria, Mycosphaerella, Sphaerulina
Septothyrella	Uleothyrium
Shearia	Pleomassaria
Sirothyriella	Morenoina
Sphaceloma	Elsinoe
Sphaerellopsis	Eudarluca
Sphaeropsis	Botryosphaeria
Stagonospora	Leptosphaeria, Mycosphaerella
Stegonsporium	Splanchnonema

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(Accepted names of teleomorphs and anamorphs)

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Splanchnonema pupula
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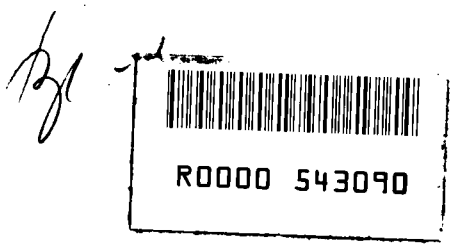
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