

STUDIES ON FOLIICOLOUS FUNGI FROM GOA AND NEIGHBOURING AREAS OF MAHARASHTRA AND KARNATAKA, INDIA

Thesis submitted to
THE GOA UNIVERSITY
For the Award of the Degree of

DOCTOR OF PHILOSOPHY IN BOTANY

*Examined. Antiqued that all corrections are
incorporated in this hard bound copy.*

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DECLARATION

I hereby declare that the Ph.D. thesis entitled 'STUDIES ON FOLICOLOUS FUNGI FROM GOA AND NEIGHBOURING AREAS OF MAHARASHTRA AND KARNATAKA, INDIA' submitted to the Goa University, forms an independent work carried out by me in the Department of Botany, Goa University, under the supervision of Dr. D.J. Bhat, Professor and Head, Department of Botany, Goa University, and the thesis has not formed previously the basis for the award of any degree, diploma, associateship or other similar titles.



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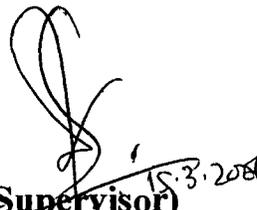
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CERTIFICATE

I certify that the thesis entitled 'STUDIES ON FOLICOLOUS FUNGI FROM GOA AND NEIGHBOURING AREAS OF MAHARASHTRA AND KARNATAKA, INDIA, submitted by Miss. Pratibha S. Jalmi, is a record of research work done by her during the period from 2003 - 2006 when she worked under my supervision. The thesis has not formed the basis for the award of any degree, diploma, associateship, or fellowship to Miss. Pratibha S. Jalmi.

I affirm that the thesis submitted by Miss Pratibha S. Jalmi incorporates the independent research work carried out by her under my supervision.




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CHAPTER I
INTRODUCTION

Fungi are heterotrophic and live in a wide range of habits and habitats. Being achlorophyllous, they exhibit an absorptive mode of nutrition and lead saprophytic, parasitic or mutualistic existence. As saprophytes, along with bacteria and micro- and macro-fauna, fungi bring about complete decomposition of plant and animal remains. As parasites, they cause diseases in plants and animals. As mutualists, fungi are known to live in intimate association with other organisms. In nature, fungi exploit an infinite diversity of nutritional micro-niches. Fungi are also diverse in form, size, physiology and mode of reproduction (Dix and Webster, 1995; Hawksworth, 2001). Utilization of biological capabilities for advantage has resulted in the application of many species of fungi in various useful processes such as agriculture, bioremediation, fermentation, food, industry and medicine (Kendrick, 1992).

Fungi are capable of reproducing both sexually and asexually. The phase associated with production of asexual spores is known as the asexual or imperfect state or the anamorph or mitosporic phase. The formation of spores resulting from a sexual process is called the sexual or perfect state or the teleomorph or meiosporic phase. Tulasne and Tulasne (1861-1865) first recognized fungal pleomorphism; that is, fungi can produce different fructifications in their life cycles. They described the physical link between perfect and imperfect phases. Fuckel (1870) was the first to recognize the asexual phases of fungi in a separate group – the ‘Fungi Imperfecti’. The later term introduced for this miscellaneous assemblage of microscopic fungi, which reproduce asexually, is ‘mitosporic fungi’ (Hawksworth et al., 1995). Their relationship to a sexually reproducing fungus is frequently unknown and in some, sexuality is lost. Broadly defined, they are ‘conidium’ forming fungi, where spores are formed without fusion of nuclei or meiosis. Those reproducing sexually or

showing sexual expressions are perfect fungi (Ascomycetes and Basidiomycetes). The imperfect phase may occur separately in time and/or space from their respective sexual phases and may have evolved as discrete entities (Boshoff, 2001).

Diversity of fungi:

Only 5-10% of fungal species have been described, documented and put to use (Hawksworth, 2001). Explorative investigations are in progress and more and more fungi from less-explored regions of the world are coming to light (Hawksworth, 1991; Rossman 1994; Hawksworth, 2001; Sarbhoy et al., 1986, 1996). Within the fungal domain, micro-fungi are a diverse but comparatively less documented group (Rao et al., 2003; Rao et al. 2004). Nevertheless, systematic investigations, carried out over the years, on saprophytic, parasitic and mutualistic microfungi have resulted in the making of several fungal monographic treatments (Braun, 1987, 1995, 1998; Chupp, 1954; Ellis, 1971, 1976; Hsieh and Goh, 1990; Ingold, 1975; Lundquist, 1972; Matsushima, 1971, 1975; Nag Raj, 1993; Sivanesan, 1984; Subramanian, 1971; Sutton, 1980). Further, while a few studies were directed at measuring the abundance and diversity of microfungi that inhabit the plant litter (Heredia, 1993, Wicklow and Carroll, 1981; Bills and Polishook, 1994), several investigations elucidated the process of decomposition of plant tissues in a variety of habitats (Barlocher, 1992; Dix and Webster, 1995).

Tropical belt, with high rainfall, humidity and temperature, is known to encompass the most diverse and weird habitats of the globe and thereby constitute a major reservoir for the living organisms, be it plants, animals or microorganisms (Hawksworth, 1991). Amongst the microbes, fungi are the most important and versatile living components of tropical ecosystems (Hyde, 1997; Bhat and

Raghukumar, 2000). Recent studies, involving modified fungal recovery techniques, have shown that even small samples of tropical rainforest leaf litter yield very large number of different species of micro-fungi (Bills and Polishook, 1994). About 80,000 fungal species have been described worldwide of an estimated 1-1.5 M fungal taxa (Hawksworth, 1991; Rossman 1994).

Significance of fungi:

Individually, fungi occupy less space. However, they secrete a variety of enzymes and decompose a wide spectrum of organic materials, which include plants and plant products such as fallen leaves, twigs, timber, logs, poles, paper, etc. Fungi are capable of attacking many products and produces including cloth fabrics, leather goods, various petroleum hydrocarbons and almost all foodstuffs. Besides spoilage of food, certain species of fungi produce toxic substances known as mycotoxins. (Kendrick, 1992).

There are references indicating that since early times humans have consumed mushrooms such as *Termitomyces* spp. as food and *Amanita* spp. as hallucinogens (Subramanian, 1993). Cultivated edible mushrooms are now a major industry (Pointing and Hyde, 2001). Fungi have been used to produce a variety of compounds such as ergosterol by *Claviceps purpurea* and zymosterols by *Saccharomyces cerevisiae*; enzymes such as amylase, cellulases, lipases and peroxidases by *Aspergillus* spp.; acids such as fumaric acid by *Rhizopus nigricans*, lactic acid by *Rhizopus oryzae*, succinic acid by *Aspergillus flavus* and oxalic acid by *Penicillium oxalicum*; plant growth regulators such as gibberellins and abscisic acid by *Fusarium moniliforme*; antibiotics such as penicillin by *Penicillium chrysogenum* and alcohols by strains of *Saccharomyces cerevisiae* (Alexopoulos et al., 1996). Fungi ferment

organic waste into usable products such as methane and biofertilizers (Fox, 1993). New classes and sources of natural products are being discovered from fungi almost everyday (Pointing and Hyde, 2001). Anamorphic fungi are producers of important biologically active molecules (Seifert and Gams, 2000), which include cyclosporin A, the immune-suppressant drug used in organ transplant operation produced by *Beauveria nivea* and the cholesterol-reducing lovastatin derived from *Aspergillus terreus*. A previously undescribed fungus isolated from Pacific yew tree, *Taxomyces andreanae*, was shown to produce taxol, a drug effective in suppressing breast cancer (Stierle et al., 1993).

Fungi play a vital role in agriculture. While the pathogenic fungi cause damage, mycorrhizae enable reduction in the usage of chemical fertilizers to crop plants (Jong and Birmingham, 1993; Wood, 1992). About 90% of all vascular plants require the association of fungi with roots either as ectomycorrhizae or endomycorrhizae (Allen, 1993). Besides, fungi serve as beneficial organisms in the biological control of insects, pathogenic fungi and weeds (Miller and Rossman, 1994; Roberts and Hajek, 1993; Trujillo, 1993).

Applications of fungi in various human welfare activities demanded maintenance of fungi in pure culture condition, in recognized repositories (Gams, 2001). World-renowned culture collections are there but only 13,600 of the total 80,000 species of fungi known so far exist in culture.

Fungi on leaf surface:

Fungi are known to occur on plant surfaces as epiphytes and inside the plant tissues as endophytes. Epiphytes mostly exhibit visual symptoms on plant surface but sometimes affect growth and morphology of the host whereas endophytes largely

remain as symptomless residents inside the plant tissues (Bills, 1996). Aerial plant surface as a habitat for fungal growth has been first recognized by (Last, 1955). Microclimate of the leaf surface is said to be different from that of surrounding air (Dickinson, 1967). Leaf surface is known to form a home for diverse microbial population, which mainly includes fungi and bacteria. Amongst the fungi, members of Deuteromycetes and Ascomycetes dominate the surface of leaves (Last and Deighton, 1965).

Leaves arising laterally and exogenously at the stem apex are organs of limited growth. They are mostly compressed dorsiventrally and constitute a distinct microhabitat, 'the phylloplane', which is inhabited by varied assemblage of saprophytic and parasitic fungi. Besides the nutrients mostly leached out from internal in limited quantity, leaf surfaces also contain substances that inhibit fungal growth. Topography of leaf surface has an effect on microbial inhabitants, particularly for fungi (Dickinson, 1967).

Fungi inhabiting living leaves or phylloplane of plants are considered as 'foliar fungi' (Dix and Webster, 1995). Amongst them, those infecting the living leaves and establishing biological relationship with the plant are referred as 'foliicolous' (Hawksworth et al., 1995). Some fungi such as sooty moulds inhabiting leaf surfaces do not have direct interaction with the host, to begin with. It was assumed earlier that these moulds grow upon honey dews deposited by insects but later found that these organisms can also grow beyond the honey dew and draw nutrition from the organic matter deposited on the leaf surface or from leaf exudates (Dickinson, 1976).

Season, age of the plant and nutritional status of the leaf, together control the nature of colonization by foliar fungi (Last and Deighton, 1965; Dix and Webster,

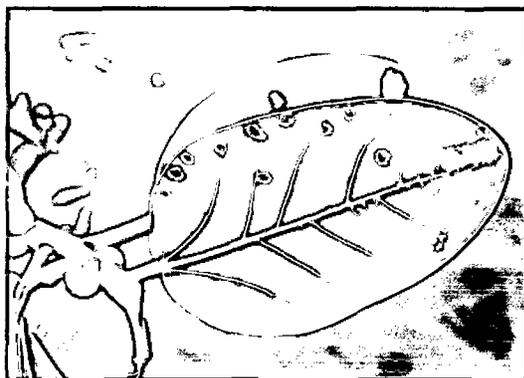
1995). The foliicolous fungi often inflict diseases on plants resulting in a variety of symptoms. The invaded area on the leaf results with leaf spots of varying colour, shape and size depending on the host and pathogen interaction. Depending upon the appearance, the leaf-spots are termed as discoloration, blight, sooty-spot, rust, shot-hole, tar spot, powdery mildew and so on (Rangaswami, 1998). When the leaf spots are numerous and extend all over the surface of the leaf, there is considerable reduction in the productivity of the host plant. Rapid defoliation that occurs due to leaf-spot diseases also cause reduction in productivity (Rangaswami and Mahadevan, 1999).

Foliicolous fungi

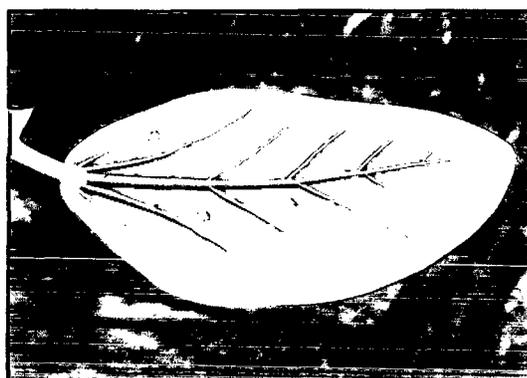
Foliicolous fungi may extend their mycelium internally in the host tissue and form reproductive spores often on the surface of leaf. They are in contact with and under the influence of both, the leaf and the atmosphere. Foliicolous fungi of a wide variety of plants have been studied for their diversity and ecology in several laboratories around the world (Dix and Webster, 1995).

In general terms, foliicolous hyphomycetous fungi can be diagnosed and described as follows: *Fungi* producing leaf spots on both (amphigenous) or on either of the surfaces (epiphyllous or hypophyllous) of the leaf, which are circular to irregular, variedly coloured, of different size (in mm diam.), may later extend over entire leaf surface. *Colonies* may be pointed or effuse, variedly coloured, growing superficially or with mycelium extending into interior of substrate tissue; the mycelium may be composed of branched, septate, hyaline to subhyaline, smooth or verrucose hyphae. *Conidiophores* macronematous or micronematous, mononematous (solitary or in loose fascicles) or synnematous, erect, straight to flexuous, septate,

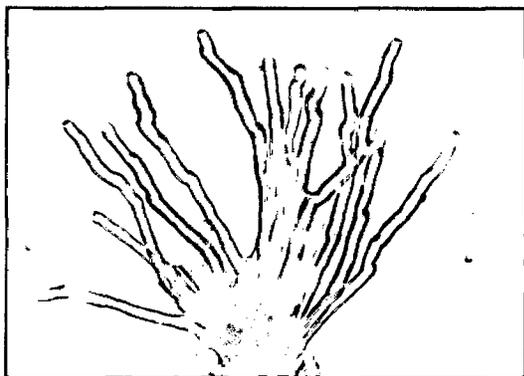
unbranched or branched one to several times, variedly coloured, smooth or verrucose, of ranging size (length x width μm). *Conidiogenous cells* phialidic, blastic, annelidic or tetric, integrated or discrete, of varied shape size and colour. *Conidia* solitary or catenate (simple, branched), endogenous or exogenous (acrogenous or acropleurogenous), hyaline or dematiaceous, variedly sized (in μm), septate (eu- or a- or pseudo-), dry or slimy. *Teleomorph* may be known or unknown”.



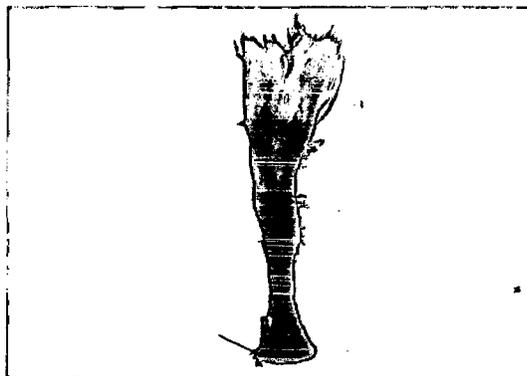
Epiphyllous leaf spots



Hypophyllous leaf spot



Mononematous conidiophores and conidia



Synnematous conidiophores

The following genera of Hyphomycetes are, in general, considered as foliicolous (Braun, 1998; Deighton, 1959; Ellis, 1971, 1976): *Cercospora* Fresen., *Cercosporiella* Sacc., *Cercostigmia* Braun, *Cercosporidium* Earle, *Corynespora* Gussow, *Gonatopragmium* Deighton, *Helicomina* Olive, *Mycocentrospora* Deighton, *Mycovellosiella* Rangel, *Paracercospora* Deighton, *Passalora* Fr.,

Phaeoisariopsis Ferraris, *Phaeoramularia* Muntanola, *Pseudocercospora* Speg.,
Pseudocercospora Deighton, *Pseudophaeoramularia* Braun, *Ramularia* Unger,
Stenella Sydow, *Stigmina* Sacc., *Thecogonia* Sutton.

Present work

Several students have worked on taxonomy, ecology and biology fungi of the forests of Western Ghats of Goa and neighbouring regions, in this laboratory, since 1996 (Jacob, 2000; D'souza, 2002; Nair, 2002; Keshava Prasad, 2003). Encouraged by interesting and significant results obtained from these studies and lack of detailed knowledge on systematics and biology of foliicolous fungi of Goa and neighbouring regions of Western Ghats, the present work was undertaken during the period of January 2003 to August 2005 with following objectives. Major emphasis has been made on foliicolous Hyphomycetes.

- Documentation of foliicolous fungal diversity on living leaves of dicot and monocot plants of Goa and adjoining areas of Maharashtra and Karnataka.
- Analysis of relationship and specificity of foliicolous fungi with their host plants.
- Conservation of isolated fungi in *ex situ* fungal culture collection.
- Enzymatic activity of isolated fungi.

Considering the vast array of plants and a wide range of vegetation present along the region, it was felt that a high incidence of diverse foliicolous fungi could be encountered from such an investigation.

The work carried out from January 2003 to July 2005 is presented in four chapters in the thesis. As can be seen, in Chapter I, the topic of study is introduced. A detailed review of literature is given in Chapter II. The material used and methods

followed during the study are elaborated in Chapter III. Results obtained are detailed out and further discussed in Chapter IV. Photographic and line drawing illustrations of the fungi described has also been provided. An exhaustive list of references is given at the end of the thesis. A list of publications emanated during the course of this study is appended to the thesis.

CHAPTER II

REVIEW OF LITERATURE

The origin of understanding of fungi appears to be as old as the human quest for knowledge. The 'Soma' of "Rigveda" (about 3500 B.C.) was thought to be the mushroom, *Amanita muscaria*. "Atharvaveda" has indirect references to edible and poisonous mushrooms. Reference of 'ailment of plants due to fungi' is available in the holy Bible (Amos 4:9). Charaka's 'Samhita' (600 A.D.) refers fungal skin diseases and their prevention. The ancient 'mushroom stones' of the period 1000 B.C. - 200 A.D., found even today in several parts of the world speaks of the early human interest in fungi (Lowly, 1971; Wasson and Wasson, 1957). References of fungi and their involvement in human life can be found in early writings of Hebrew, Greek, Roman and Chinese. The Medieval era (7th to 15th centuries A.D.), however, remained as 'dark period' in mycology, probably due to the mysticism and superstitions, which emanated from the powerful religious lobbies of those days.

History of Fungal Systematics

Systematic reference to fungi can be seen, for the first time, in the book of C. Excluse alias Clusius entitled 'Rariorum Plantarum Historica' wherein 47 fungi were described. Bauhin (1623) listed nearly 100 fungi belonging to Agaricaceae, Auriculariaceae, Boletaceae, Clavariaceae, Lycoperdaceae, Pezizaceae, Phallaceae and Polyporaceae in his work 'Pinus Thearti Botanici'. Hooke (1667) published the first illustrated document of microfungi named 'Micrographia', which included reference to *Mucor*. Leeuwenhoek in 1680 observed anamorphic yeasts undergoing multiplication by 'budding'. Subramanian (1971) gave credit to P.A. Micheli, an Italian botanist, as the first biologist to have given generic names to certain fungi, which are still classified in the Hyphomycetes. The classification system used in Micheli's (1729) masterpiece 'Nova Plantarum Genera' was morphology-based and

amongst several genera described by him, two namely, *Aspergillus* and *Botrytis* are still in use.

Carl Linnaeus, during 1735-1752, reported 9 genera of fungi in his 'Systema Naturae' (1735), 11 genera in 'Genera Plantarum' (1737a) and 8 species belonging to 6 genera in 'Hortus Cliffortianus' (1738). Linnaeus described 47 species of *Agaricus* in his 'Flora Lapponica' (1737b). Though he introduced "binomial nomenclature" in his 'Species Plantarum' he did not do as much justice with fungi as he did with the flowering plants. 'Fungi Mecklenburgenses Selecti' (1790-1797) was one of the oldest local fungal floras published by H.J. Tode, who was accredited for initiating maintenance of fungi as herbarium specimens. Bulliard (1791) published 'Champignons de France' which contains descriptions and accurate drawings of many of the microfungi, especially members of Mucorales, Pyrenomycetes, Discomycetes and Mycetozoa.

The first comprehensive work in which diverse taxonomic works of those times were brought together was the 'Synopsis Methodica Fungorum' of Persoon (1801). C.H. Persoon (1761-1836), a great mycologist of that time, through his 'Observations Mycologicae' (1795-1799), 'Tentamen Dispositionis Methodicae Fungorum' (1797), 'Icones Description Fungorum' (1798, 1800), 'Synopsis Methodica Fungorum' (1801), 'Icones Pictae Specierum Rariorum Fungorum' (1803-1808), 'Traite Champignons Comestibles' (1818) and 'Mycologia Europaea' (1822-1828) laid the foundation for systematic and scientific classification of fungi. Persoon included 15 generic names of Hyphomycetes in his 'Synopsis'. He divided fungi into two main classes on the basis of whether their fructifications were open or closed. H.F. Link during 1767-1851 in his 'Observations I' (Link, 1809) and 'Observations II' (Link, 1815) established several genera of Hyphomycetes, which accommodated

some of the commonest genera such as *Acremonium*, *Fusarium*, *Geotrichum*, *Oidium* and *Trichothecium*.

The great Swedish mycologist, E.M. Fries who is considered as the founder of systemic mycology, presented his work in 3 volumes of *Systema Mycologicum* (1821-1832). He dealt Hyphomycetes briefly in the second part of the third volume and his treatment has been chosen as the starting point for nomenclature of conidial fungi.

J.H. Leveille during 1796-1870 studied the larger fungi, Hymenomycetes, and introduced the term basidium. He thought that fungi were exanthemata, i.e. modification of host tissue. M.J. Berkeley (1803-1889) was the first to use the term 'mycology' in English language. He wrote over 400 papers on and named approximately 6000 species of fungi. His 'Introduction to Cryptogamic Botany' and 'Outlines of British Fungology' were published in 1987 and 1860 respectively. M.C. Cooke during 1875-1892 established the journal of *Grevillea* and served as its editor. He wrote the 'Handbook of British Fungi' (Cooke, 1871) and 'Handbook of Australian Fungi' (Cooke, 1892).

Fries during 1836-1838, in his 'Epicrisis Systematis Mycologia' recognized 6 Classes and separated Discomycetes from Hymenomycetes and Pyrenomycetes from Gasteromycetes. He collected about 3000 species of fungi in North Carolina and Pennsylvania, 1200 of which he described as new in 'Synopsis Fungorum Carolinae Superioris' and 'Synopsis Fungorum in America Boreali Media Degentium'. Corda (1837) published volume of his 'Icones fungorum hucusque cognitorum'. In 1842, he described the new family Melanconiaceae, within the order Myelomycetes, for some of them, and also put most pycnidial genera in either the Sphaeriaceae or Sphaeronemeae of the same order.

The dual mode of life in fungal propagation, sexual and asexual, has been known from the time of Tulasne brothers (Gams, 1995). L.R. and C.R. Tulasne's monumental work 'Selecta Fungorum Carpologia' (1861-1865) in Latin gave the basic evolutionary idea of polymorphism in fungi. L.R. Tulasne who was called the 're-constructor of Mycology' made additions to the knowledge of smuts, rusts, ergot, subterranean fungi, Pyrenomycetes, higher fungi and lichens. They discovered several Hyphomycetes or imperfect fungi whose connections were known in Ascomycetes and Basidiomycetes.

De Bary (1854) and Brefeld (1874) pioneered use of pure culture techniques that became essential to discover the teleomorph connections or to establish pleomorphy. Fuckel (1870) perceived the complex organization of fungi and introduced the term Fungi Perfecti and Fungi Imperfecti. Investigations on anamorphic fungi proceeded largely independently of studies on teleomorphic fungi. In other words, the process of understanding of relations between anamorphs and teleomorphs was gradual.

P.A. Saccardo (1873, 1884, 1886) initially adapted Fuckel's classification, but later created the name Deuteromycetae from which were derived the terms such as Deuteromycetes and Deuteromycotina. In 1884, he introduced the first comprehensive classification for imperfect fungi, mainly based on structure and shape of conidiophores and septation and pigmentation of conidia. He described spore types and coined Latin names for these fungi. 'Sylloge Fungorum', the essential contribution of Saccardo (1882-1931), comprises of 26 volumes, the first having been published in 1882. Saccardo divided the Hyphomycetes into 4 families, namely, Mucedinaceae/ Moniliaceae characterized by hyaline or lightly pigmented conidia and conidiophores; Dematiaceae with conidiophores and conidia more or less pigmented;

Tuberculariaceae with short conidiophores borne on a cushion-shaped sporodochium; and Stilbaceae with long conidiophores forming synnemata. Within these 4 groups, several morphological spore types such as amero-, dictyo-, didymo-, helico-, phragmo-, scoleco- and staurospores, were recognized based on shape and septation. Costantin (1888) in 'Les Mucedines Simples' proposed a different classification for Hyphomycetes, where attachment of conidia to parent hyphae was given a diagnostic importance. Ontogenetic characters were thus given recognition in taxonomy.

Potenzia (1910) sub-divided Fungi Imperfecti based on the fructifications. He clubbed acervular and sporodochial fungi in Acervulales, genera with incomplete or atypical pycnidia in Pseudopycnidiales, and typical pycnidial forms in Pycnidiales. Grove (1919) introduced the term Coelomycetes and later expanded the initial concept to include imperfect fungi with acervular and pycnidial conidiomata (Grove, 1935).

Vuillemin (1910, 1911) in 'Les Conidiospores' and 'Les Aleureospores' proposed a system of classification for Hyphomycetes based on biological process of conidium formation; it was in essence an ontogenetic approach to systematics. Mason (1933) recognized Vuillemin's idea of conidium ontogeny and projected an advanced system of classification based on spore development. He reworked Vuillemin's concepts of the phialide and proposed different term for the structures, namely meristem spores for the phialospores. He suggested that spores in asexual fungi could be of two types – dry or slimy, the former being disseminated by wind and the latter by insects or water. Later workers (Barron, 1968; Hughes, 1953; Tubaki, 1958; Subramanian, 1962; 1971; Kendrick, 1981) disagreed with Mason's wet and dry spore definitions and proposed an advanced system of classification of the Hyphomycetes based on differences in conidium origin and development. Hughes (1953) declared

that conidium ontogeny be used as a primary character for sorting imperfect fungi. Sutton (1980) introduced a complex terminology of classes, subclasses, orders and suborders differentiated by conidiogenesis and stroma type, into which he integrated Hyphomycetes and Coelomycetes. Subramanian (1983) comprehensively reviewed previous attempts of classifications and proposed his own arrangement in orders and families. The recent Dictionary of Fungi (Kirk et al., 2001) gives a refined taxonomic treatment for the fungi.

Mycology in India

Studies on fungi in India began with foreign visitors, mainly from Britain who collected fungi and sent specimens to European laboratories for identification. Barclay and Cunningham initiated investigations of fungi in India. Barclay (1886) investigated the rusts occurring in the vicinity of Shimla. Cunningham (1927) contributed to Orders Mucorales, Ustilaginales and Uredinales. Among the Indian mycologists, Lt. Col. Kirtikar of the Indian Medical Services was the first person to have taken up the study of fleshy fungi in 1885 and this marked the beginning of Indian initiative in mycology. Hitherto, researches on fungi have been largely on floristics (Bisby, 1933; Vasudeva, 1963; Tilak and Rao, 1966; Mukerji and Juneja, 1974; and Bilgrami et al., 1979). It was, however, left to Sir E.J. Butler who has been regarded as the 'Father of Indian Mycology', to initiate and organize large-scale mycological and phytopathological research in India since the turn of last century. His book 'Fungi and Diseases in Plants' (Butler, 1918) provided a useful reference material to tropical plant pathologists. Butler and his associates compiled information as 'Butler and Bisby's (1931) The Fungi of India', which has been revised several times and further updated (Mukerji and Juneja, 1974; Sarbhoy et al., 1986, 1996;

Jamaluddin et al., 2004). Comprehensive reviews on hitherto studies on fungi of India are now available (Subramanian, 1971, 1983, 1986, 1991; Rao et al., 2004; Manoharachari et al., 2005).

Foliicolous fungi:

Fries in 1849 first recognized the leaf surface inhabiting fungi while he described *Passalora*, the first genus of the *Cercospora*-complex with *P. bacilligera* as type species. Fresenius (1863) introduced the genus *Cercospora* to accommodate species close to *Passalora* but distinguishable by long, pluriseptate conidia. De Bary (1866) described *Dematium pullulans*, a fungus commonly occurring as foliar pathogen. Potter in 1910 initiated study of leaf surface inhabiting fungi, which were called as phyllosphere fungi by Last (1955) and phylloplane flora by Kerling (1958). Subsequent studies (Ruinen 1961; Dickinson, 1965; Dix and Webster, 1995) suggested that an active population of fungi exist on the surface of physiologically active green leaves.

Leben (1965) distinguished phylloplane flora into 2 types, the 'casuals' and the 'residents'. The casuals consisted of organisms that are firmly lodged on the surface but did not germinate on or colonize the leaf surface. The residents were more acclimatized on the phylloplane, as saprophytes. The inability of casuals to grow on the leaf surface was attributed to factors such as unfavourable surface texture, lack of essential nutrients, host specificity and competition with the resident organisms (Ruinen, 1966; Last and Deighton, 1965).

Dickinson (1976) classified the phylloplane fungi into three categories: non-pathogenic, pathogenic and exochthonous. The non-pathogenic fungi are able to grow in all conditions but sporulate only at the onset of senescence. The pathogenic fungi

are wholly or partially restricted to the phylloplane and survive long periods on the phylloplane prior to penetration. The phylloplane formed an essential link in the life cycle of exochthonous fungi though the fungi did not derive any advantage from the habitat.

Following is the list of those contributed significantly to the study of foliicolous fungi around the world:

Mycologist and reference	Institution of work and region covered	Major area of work
Bagyanarayana (1999)	Osmania University, A.P., India	Rusts of India
Braun (1995)	Institute fur Geobotanic und Botanischer Garten, Germany; world wide coverage	Monograph on <i>Cercospora</i> , <i>Ramularia</i> and allied genera
Chiddarwar (1960)	Agharkar Research Institute, Pune, Maharashtra, India	Monograph on <i>Cercospora</i>
Chupp (1954)	Cornell University, Ithaca, New York, USA; world wide coverage	Monograph on <i>Cercospora</i>
Crous et al. (2000)	University Stellenbosch, South Africa; Indonesia and Africa	<i>Mycosphaerella</i> and their anamorphs
Deighton (1959)	Commonwealth Mycological Institute, Kew; Africa	Cercosporoid fungi
Ellis (1971, 1976)	Commonwealth Mycological Institute, Kew; world wide coverage	Dematiaceous Hyphomycetes
Govindu and Thirumalachar (1964)	UAS, Bangalore; Karnataka, India	Indian <i>Cercosporae</i>
Guo (1991)	Institute of Microbiology, Academic Sinica, Beijing; China.	Foliicolous hyphomycetes
Hosagoudar (1996)	TBGRI, Thiruvananthapuram, Kerala, India	Meliolales from India
Hsieh and Goh (1990)	National Chun Hsing University, Taichung, Taiwan	Monograph on <i>Cercospora</i>
Inacio and Dianese, 1998	Department de Fitopatologia, Universidade de Brasilia, Brazil	Foliicolous fungi
Kamal, et al. (1989)	Gorakhpur University, Gorakhpur, India and Nepal	Foliicolous fungi
Kar and Mandal (1969) <i>et al.</i>	Presidency college, Calcutta, India	<i>Cercospora</i> and allied genera
Manoharachary (2005)	Osmania University,	Cercosporoid fungi

	Hyderabad, India	
Nakashima et al. (2004)	National Institute of Technology and Evaluation, Japan	Cercosporoid fungi
Singh (2003)	Agharkar Research Institute, Pune, India	<i>Phaeoramularia</i>
Vasudeva (1963)	Indian council of Agriculture Research, New Delhi, India	<i>Cercospora</i>

Among the foliicolous fungi so far described, Hyphomycetes are the dominant in the tropics and sub-tropics, including Indian sub-continent. Significant hitherto contributors for the study of foliicolous fungi of India are the following: Prof. Kamal and his students in the north-eastern India including Nepal (Kamal and Singh, 1980; Kumar and Kamal, 1979; Rai and Kamal, 1982; Kamal et al., 1985; Verma and Kamal, 1987, 1991; Verma and Kamal, 1987) while Hosagoudar (1997), Vasudeva (1963), and Govindu and Thirumalachar (1964) in the southern India.

Amongst the Hyphomycetes, Cercosporoid fungi were the maximum (Chaudhary et al., 1996; Crous and Braun, 1996; Braun and Sivapalan, 1999; Bhalla et al., 2001; Braun et al., 2002; Braun and Pennycook, 2003; Braun and Hill, 2004). The Cercosporoid fungi are divided into 2 groups: *Cercospora-Cercosporidium* complex and *Cercosporiella-Ramularia* complex (Braun, 1997). Major genera of Cercosporoid fungi such as *Cercospora*, *Corynespora*, *Gonatophragmium*, *Mycovellosiella*, *Passalora*, *Phaeoramularia*, *Pseudocercospora*, *Pseudocercosporiella*, *Stenella*, etc. are briefly described here.

Cercospora:

The genus *Cercospora* was established by G. Fresenius (1863), based on the type *C. apii* Fres, a leaf parasite that causes brown spots of celery. It is one of the largest genera of the Hyphomycetes with over 3000 species epithets. Fungi in the genus *Cercospora* are among the most prevalent of plant pathogens. As a group, they

are generally pathogenic occurring on a wide range of hosts in almost all major families of dicots, most monocot families, and even some gymnosperms and ferns (Goodwin et al., 2001).

The fungi are characterized by coloured conidiophores. Since Fresenius did not give a clear-cut definition, Saccardo (1880) described it as having brown conidiophores and brown, olivaceous to sub-hyaline, vermiform conidia. Spegazzini (1910) split the genus *Cercospora* and accommodated those species with hyaline conidia under a new generic name *Cercosporina*. He also separated *Pseudocercospora* from *Cercospora* based on presence or absence of darkened and thickened conidial scars and hilum. Saccardo in 1913 agreed with the establishment of *Cercosporina* and transferred 89 species from *Cercospora* including some with coloured as well as hyaline conidia into the former. Later Miura (1928) transferred *Cercospora apii* to *Cercosporina*. Considering the presence or absence of external mycelium and prominent stromata, branching of conidiophores, as well as the shape of conidia, Solheim (1930) proposed 21 sections of *Cercospora*. Solheim and Steven (1931) reconsidered their classification of *Cercospora* by adding the character of conidial scars and divided the genus into 38 sections.

Chupp (1866-1967) made significant contribution to our knowledge of *Cercospora*, which he monographed in 1954 wherein he compiled 1758 species of the genus including numerous new species. Katsuki (1965) published a monograph of Japanese Cercosporae including 226 species based on Chupp's old criteria. Deighton (1967, 1973, 1974, 1976) segregated and reclassified several *Cercospora* species in other genera namely, *Cercosporella*, *Cercosporidium*, *Paracercospora*, *Pseudocercosporella*, *Pseudocercospora* and *Pseudocercosporidium*. This broad assemblage is now referred to as '*Cercospora* complex'. Therefore, species of

'*Cercospora* proper' are characterized by conspicuously thickened and darkened conidial scars and hyaline to sub-hyaline, acicular, filiform, multiseptate conidia.

According to Assante^{et al.} (1977) many species of *Cercospora* are characterized by production of phytotoxic metabolite of polyketide originally called as cercosporin. Fajola (1978) concluded that cercosporin production is associated with 'true' *Cercospora* species and those species that do not produce cercosporin might belong to other related genera. Pons and Sutton (1988), described *Distocercospora* for cercosporoid hyphomycetes having distoseptate scolecospores. Pons and Sutton (1988) and Braun (1993), split *Cercospora* 'sensu lato' into numerous smaller genera based on morphological aspects exhibited by the conidiogenous loci and the conidial hila. Braun (1995), Braun and Melnik (1997) and Crous et al. (2000) published reviews on *Cercospora*-like generic assemblage. Crous et al. (2000) reduced the number of species of *Cercospora* based on the molecular studies. Kobayashi et al. (1998, 2002), Nakashima^{et al.} (2004) and Nakashima et al. (2002) added several species of *Cercospora* into Japanese mycoflora.

Corynespora:

While studying leaf spot diseases of glasshouse grown cucumber, Gussow (1906) established the genus *Corynespora*, with *C. mazaiei* as type. He proposed the new genus on the basis that the conidia are formed in chains and there is a hyaline isthmus connecting conidiophore and conidium but had ignored the earlier epithet *Cercospora melonis* Cooke. Lindau (1910) treated the two species as one under the name *Corynespora melonis* (Cooke) Lindau. The same fungus was later observed on soyabean (*Glycine max*) and was identified by Tai (1936) and Teng (1939) as *Cercospora vignicola*. Wei (1950) reinvestigated the genus and accommodated *C.*

vignicola and *Helminthosporium cassicola* under *Corynespora cassicola*. The genus is characterized by non-stromatic conidiophores terminally proliferating through the scars of fallen conidia reaching a length up to 800 µm and conidiogenous cells bearing catenate, distoseptate conidia with hyaline exospore and conspicuous hilum. *Corynespora* contains about 108 species described from all over the world, most of which are reported to be parasites on plant leaves, but some have also been reported to survive saprophytically on plant parts including leaves, bark and wood.

The first contribution made from India was by Solheim (1933) who described *Corynespora colebrookiae* on *Colebrookia oppositifolia*, a specimen collected from Maharashtra. Ellis (1961) described *C. siwalika* on *Helicteris isora*, which was a recombination in *Helminthosporium siwalikum* Subram. Rao (1961) described *C. ficicola* on *Ficus hispida* from Warangal, A.P. A major contribution was made by Meenu et al. (1997, 1998) who described 9 species of *Corynespora*, viz. *C. alstoni* on *Alstonia scholaris* and *C. woodfordiana* on *Woodfordia fruticosa* from Butwal, Nepal; *C. euphorbiacearum* on *Manihot esculentus*, *C. nana* on *Lantana indica*, *C. rosacearum* on *Eriobotrya japonica*, *C. morindae-tinctoriae* on *Morinda tinctoria*, *C. cucurbiticola* on *Coccinia grandis*, *C. jasminiicola* on *Jasminum arborescence*, *C. trictoides* on *Triumphetta rhomboidea* from Gorakhpur, and Kathmandu, Nepal. Singh et al. (2000a) added 3 more species to *Corynespora* from India viz. *C. ulmacearum* on *Trema orientalis* and *C. pedaliacearum* on *Sesamum indicum* from Gorakhpur and *C. schleichericola* on *Schleichera trijuga* from Siddharthnagar. *C. elephantopi*, *C. lepidagathii-hyalinae* and *C. melanthesae* on the hosts *Elephantopus scaber* from Gorakhpur, *Lepidagathis hyalina* from Siddharthnagar and *Melanthesa rhomboides* from Mahrajganj were also contributions from Singh et al. (2000b).

Sharma et al. (2002) reported 3 more species of *Corynespora*, viz., *C. trematicola* on *Trema orientalis*, *C. viticola* on *Cayratia carnos*a from Gorakhpur and *C. solanii* on *Solanum indicum* from Nichlaul forest. Sharma and Srivastava (2003) reported 9 new species and a new variety occurring on living leaves of different hosts belonging to 10 different families. These are *C. buchmaniae*, *C. crotolaricola*, *C. jabalpurensis*, *C. luffae-cylindrica*e, *C. meliacearum*, *C. melongenae*, *C. nana* var. *bifurcata*, *C. oleacearum*, *C. robusta* and *C. xanthiigena*.

Gonatophragmium:

Deighton (1969) established the foliicolous genus *Gonatophragmium* with *G. mori* (Sawada) Deighton as the type. Mulder in 1973 added the second species, *G. mangiferae* on *Mangifera indica* from the tropical country, Burma. After a long gap, Rai (1966) described *G. kaunensis* on *Miliusa tomentosa* from India. Tripathi and Tripathi (2003) described 9 new species viz., *G. semi-lunatum*, *G. daedalacanthi*, *G. justiciae*, *G. jarwarensis*, *G. lamiacearum*, *G. pogostemonidis*, *G. deightonii*, *G. kushinagarensis* and *G. moracearum* from India.

Mycovellosiella:

Genus *Mycovellosiella* was established by Rangel in 1917, with *M. cajani* as type. The genus currently contains over 130 species (Ellis, 1971, 1976; Deighton, 1974, 1979; Braun, 1990, 1991, 1993a, 1993b, 1995; Crous and Braun, 1994, 1995; Bhalla et al., 1996a; 1996b; Kharwar et al., 1996; Meenu et al., 1996). The generic circumscription of *Mycovellosiella* has been reviewed by Deighton (1976, 1979), Braun (1990) and Bhalla et al. (1996a). Bhalla et al. (1997) described 3 new species, *M. malloti-repandi*, *M. nerii-indici* and *M. solanacearum*, occurring on *Mallotus*

repandus, *Nerium indicum* and *Solanum verbascifolium*, respectively from India. Barreto and Marini (2002) described the new species of *Mycovellosiella*, *M. robbsii* Robert and Fillipe causing leaf spot of *Mimosa caesalpiniaefolia*.

***Passalora*:**

Fries (1849) described *Passalora*, the first genus of the *Cercospora* complex with *P. bacilligera* as type species. Deighton (1967) re-defined *Passalora* Fr. and distinguished *Cercosporidium* with its well-developed stromata. Arx (1983) treated *Cercosporidium* as synonymous with *Passalora* and this has been followed by Castaneda and Braun (1989), Deighton (1990) and Braun (1992). The characteristics of the conidia and conidial scars in *Passalora* and *Phaeoisariopsis* are identical (Deighton, 1990). The later author confined *Phaeoisariopsis* to synnematal species with conidial scars lying more or less flat against the sides of the conidiogenous cells and proposed to transfer species with more or less geniculate conidiogenous cells to *Passalora*.

***Phaeoramularia*:**

Muntanola (1960) established the genus *Phaeoramularia* to accommodate two species of *Cercospora* with internal vegetative mycelium, thickened conidial scars and brown spores. The type species, *P. gomphenicola* (Speg.) Munt., a foliicolous fungus on *Gomphrena glauca*, was originally named as *Cercospora gomphrenicola* Speg. (Speggazine, 1882). Sutton (1970) added *P. maculicola* (Rom. & Sacc.) Sutton on *Populus* sp. from Canada. Marasas and Bredel (1974) and Matsushima (1975) added 2 more species.

Von Arx (1974) tried to place *Phaeoramularia* Munt., *Mycovellosiella* Rangel and *Stenella* Sydow as synonyms of *Cladosporium* Link ex Fries on the basis of their similarities in axenic cultures. However, *Phaeoramularia* remained as a separate genus (Ellis, 1976; Deighton, 1976, 1979). Liu in 1982 described 9 species from China, viz. *P. acericola*, *P. euphorbiae*, *P. helianthi*, *P. markhamiae*, *P. barringtoniae*, *P. eupatorii-odorati*, *P. fusimasculens*, *P. panicillata* and *P. trilobi*. Guo (1986, 1987, 1989, 1993) described 4 new species of *Phaeoramularia* viz. *P. weigela*, *P. pruni*, *P. Montana* and *P. schisandrae* from Hong Kong. Braun (1992) added 2 species viz., *P. minutissima* and *P. punctiformes* from Germany. Further, Braun (1999) transferred 3 species of *Cercospora* to *Phaeoramularia* viz., *C. gilbertii* Speg. to *P. gilbertii* (Speg.) U. Braun, *C. oculata* Ellis & Kellerm. to *P. oculata* (Ellis & Kellerm.) U. Braun and *C. cephalanthi* Ellis & Kellerm. to *P. cephalanthi* (Ellis & Kellerm.) U. Braun.

About 38 species of *Phaeoramularia* are so far described from Indian sub-continent, out of which, 31 are from India, 6 from Nepal and 1 from Pakistan. Dublisch and Singh (1977) reported *P. pergulariae* as a new species from India for the first time. Deighton (in Ellis, 1976) has made significant contribution on the taxonomy of *Phaeoramularia* based on examination of authentic type specimens of the Indian species described under *Cercospora*, which resulted in transfer of 5 species to *Phaeoramularia*.

Pseudocercospora:

The genus was established by Spegazzini in 1910 to accommodate *Septonema vitis* Lev. with *P. vitis* (Lev.) Speg. as type species. The majority of species, which have been included in *Cercospora* falls into two distinct taxonomic categories: (i)

those in which the old conidial scars on the conidiophores are thickened and darkened, and (ii) those in which scars are unthickened and not darkened. Deighton (1976) gave a clear idea about thickened and unthickened scars by means of photographs. He considered *Helicomina* Olive and *Pseudocercospora* as synonyms wherein the former showed sympodial proliferation of the conidiogenous cells, which were denticulate and of varying sizes whereas no proliferation of conidiogenous cell was observed in *Pseudocercospora*. Absence of thickened conidial scars as primary features of characterization of *Pseudocercospora* was discussed by Casteneda and Braun (1989). According to Deighton (1990), sub-synnematal *Phaeoisariopsis* species with inconspicuous conidial scars must be referred to *Pseudocercospora*. He also mentioned that only species with inconspicuous, unthickened and not darkened scars should be included in *Pseudocercospora*.

***Pseudocercospora*:**

Deighton (1973) described the genus *Pseudocercospora* with *P. ipomoeae* Deighton as type. The species is characterized by unthickened, inconspicuous conidial scars. Petrak (1925) had introduced *Cercoseptoria* and placed some species with hyaline conidiophores and conidia. Arx (1983) synonymized *Cercoseptoria* under *Pseudocercospora*. The genus currently contains about 70 species (Gupta and Kamal, 1989; Mehrotra and Verma, 1992; Braun, 1990b, 1995; Singh et al., 1997).

***Stenella*:**

Genus *Stenella* was established in 1930 by Sydow with *S. araguata* Syd. as the type. Ellis (1971) redescribed the genus. Deighton (1979) transferred *Biharia vanguardiae* Thirum. & Mishra to *Stenella* as *S. vanguardiae* (Thirum. & Mishra) Deighton. He was of the opinion that *Stenella* has similarities with *Mycovellosiella*,

Cercospora and *Cladosporium* but emphasized the need to distinguish it from the latter. *Stenella* differs from *Mycovellosiella* in having rough walled mycelial hyphae and usually narrow rod-like conidia, which in most cases are catenulate, verruculose, brown, subcylindric to narrowly obclavato-cylindric and more than two septate. The conidial scars are thickened but lie flat against the spore wall. Deighton (1979), Mulder (1975, 1982), and Yen et al. (1982) contributed for separation of *Stenella* from *Cercospora*, *Mycovellosiella* and *Cladosporium*. Subsequently, several more species were shifted to *Stenella* from other genera (De Hoog et al., 1983; Sivanesan, 1984; Goh and Hsieh, 1987; Braun, 1995, 1996; Kamal and Naraiyan, 1986; McKenzie, 1982). De Hoog et al. (1983), Matsushima (1983, 1985, 1989), Casteneda (1985, 1986), Casteneda and Kendrick (1919) and Yip (1989) described several saprophytic species found on dead plant parts. A total of 128 species of *Stenella* have been described so far from around the world. Of these 78, collected from 42 different host families of flowering plants and 1 from pteridophyte, are reported from the Indian subcontinent.

Sarbhajana and Chattopadhyaya (1991) described *S. alocasiae* and *S. colocasiae* on *Alocasia indica* and *Colocasia antiquorum* respectively. Chaudhary et al. (1996) described *S. caryotae-urensis* on *Caryota urens*. Four species of *Stenella* have been described on host family Asclepiadaceae. Bhalla et al. (2001) described 2 new species *Stenella*, viz. *S. argyreiae* and *S. grewiae* occurring on *Argyrea* sp. (Convolvulaceae) and *Grewia* sp. (Tiliaceae), respectively, from the Western Ghats of India. Chaudhary and Chaudhary (2003) described 7 new species of *Stenella*, viz. *S. caseariicola*, *S. cassigena*, *S. ehertigena*, *S. euphorbiicola*, *S. glycosmiidis*, *S. michelina* and *S. smilacismacrophyllae* from India.

Ecology of foliicolous fungi:

In most cases, a leaf becomes infected when attacked by pathogen. For successful infection to occur, the following components must be present. (i) The fungus must be virulent; (ii) environmental conditions must be favorable for infection to occur, and (iii) the host must be susceptible. In every infection process, a series of distinct events occur, in succession, which leads to lesion development (Agrios, 1997). Most foliar fungi in their vegetative state can initiate infection. In majority of cases, fungal spores are the initial infective propagules. Spore germination is stimulated by nutrient diffusion from plant surface and subsequent development of germ tube, appressorium and penetration peg is influenced by presence or absence of numerous other chemicals (Nagle and Wedge, 2002).

Before a fungus colonizes its host it gets attached to the host surface. Fungal propagules have evolved sophisticated processes to locate, attach to and recognize suitable hosts. Most of them have on their cellular surface mucilaginous substances such as glycoproteins and/or fibrillar materials that aid in adherence to the host surface (Agrios 1997). Successful invasion, infection and lesion development occurs when the fungus successfully overcomes the physical and biochemical barriers of the host. In the process, several enzymes e.g., cutinases, pectinases, cellulases and lipases aid in the degradation of the host, which in turn may elicit the biochemical defenses of the host organism (Manners, 1993; Walton, 1997).

Lesions caused by foliicolous fungi are initiated when spores attach to host surfaces and germinate. The resulting germ tubes attach tenaciously to their hosts, and in some species mechanisms have evolved to perceive leaf surface topology and thereby locate natural openings such as stomata (Mendgen et al., 1996; Mendgen and Deising, 1993). Several of foliar fungi produce toxins of various kinds and some of which are host specific (Margaret and Marilyn, 2000). The entry of pathogen into host

leaf may be through stomata, but evidence is now available that the cuticle may also be enzymatically degraded (Kolattukudy, 1985).

Factors affecting the development of fungal community on leaf surfaces:

1. Cell leakage: One of the most important factors influencing the growth of microorganisms on plant surfaces is leakage from the cell. Moisture on plant surface, in the form of precipitation or condensation, tends to adhere to the leaf surfaces as a film held by surface tension, especially on hairy non-waxy surfaces. This film of water probably already contains a diverse range of materials, including pollutants from the atmosphere and into which diffuse organic materials and nutrients from the cell of the plant. In this solution can be found, all essentials for the growth of majority microorganisms: sugars, amino acids, minerals and growth factors (Turkey, 1971). Leakage from leaves tends to increase as the tissue age, primarily due to the changing physiological condition of the leaves as it matures. In young tissues, the metabolic demand for nutrients and the metabolites required for growth is high, which in turn reduces their availability in the free space and cuts down the leakage to the surface solution (Dix and Webster, 1995). When the leaf is mature it ceases to grow and becomes less competitive and consequently leakage in to the surface solution increases.
2. Competition with other microbes: Since it is well known that most spores germinate in distilled water without added nutrients or metabolic substrates but shows poor germination on the leaf surfaces. This is because of multiplication of epiphytic bacteria within the water droplet in which the spores were suspended (Blackman, 1972). The antagonistic potential of several of the common phylloplane fungi towards

other fungi has been studied by a number of people (McBride, 1971; Fokkema, 1973; Hoch and Provvidenti, 1979).

4. Plant inhibitors: Anti-fungal inhibitors that are constitutive in plant tissues as a result of normal metabolic activity are referred to as performed inhibitors, as opposed to the phytotoxins that are synthesized in response to the presence of fungus. Melin in 1946 detected water-soluble antifungal substance in the leaves of many trees.

5. Climatic factors: The leaves of terrestrial plants, projecting up into the atmosphere, present a rather inhospitable environment for fungal growth. Due to variations in climate and cycle of light and darkness and its effect on plants, rapid changes occur in the physical conditions prevailing on the leaf surface, with temperature and humidity being fluctuating. Water from rain and dew droplets wet leaf surfaces periodically but may rapidly evaporate so the fungi are continually subjected to wetting and drying cycles (Dix and Webster, 1995).

6. Temperature: Plants as well as fungi require certain minimum temperatures to grow and carry out their activities. Low temperatures are not favourable for growth of most of the foliar fungi. With higher temperatures however, pathogen becomes active and when other conditions are favourable, they infect the leaves (Agrios, 1997).

7. Moisture: Moisture influences initiation and development of infections in many interrelated ways. It may exist as relative humidity in the air, rain or irrigated water and dew droplets on leaf surfaces. Moisture is indispensable for germination of fungal spores and penetration of the host by the germ tube. It is also indispensable for the activation of fungus before infection (Agrios, 1997).

8. Wind: Wind influences the infection primarily by increasing the spread of fungal spores and to lesser extent by accelerating the drying of wet surfaces of the leaves (Agrios, 1997).

Foliicolous fungi in culture:

Though growing cultures do not serve as nomenclatural types, they are useful in identification and *ex situ* documentation of fungi. Most of teleomorph-anamorph connections so far described in fungi have been in culture only (Gams, 1995). It is also becoming clearer that ex-type cultures are better and relevant reference material than dried holotype specimens.

Most of genetic researches on fungi, both conventional and molecular, such as studies on mating behavior, dynamics of segregation and speciation and comparative analysis of DNA sequences in the reconstruction of phylogeny were carried out using cultures. Cultures render the work reproducible (O'Donnell et al., 1998). Nutritional requirement and ecological association of fungi can be studied *in vitro* using pure cultures. A wide and complex array of secondary metabolites become known from investigations *in vitro* (Beuchat, 1987; Samson et al., 1996).

It has been found useful to preserve cultures of causal agents of diseases for further comparative studies by de Hoog and Gueho in 1985. The importance of preservation of such strains has been emphasized by Subramanian (1992). Plant pathological investigations rely largely on inoculation studies that, among others, are important for determination of pathogenesis, testing of Koch postulates and estimation of resistance and susceptibility of host plants. Fungal cultures are gaining importance in the biocontrol of insects, nematodes, pathogenic and spoilage fungi and weeds (Jensen and Eilenberg, 2000).

About 3,85,000 strains are maintained in 480 registered microbial culture collections in 62 countries around the world (Samson et al., 1996). Major fungal culture collections in India include those of Defense R & D Organization, New Delhi;

Division of Mycology and Plant Pathology, IARI, New Delhi; National Collection of Industrial Microorganisms, NCL, Pune and Microbial Type Culture Collection, IMTECH, Chandigarh.

Compared to litter-inhabiting Hyphomycetes or Ascomycetes, most of hitherto described foliicolous fungi are known only from natural substrates. Strangely, efforts to culture and preserve the foliicolous fungi has so far been very rare (Ellis, 1971, 1976; Matsushima, 1971, 1975; Hawksworth, 2001). This might be due to the fact that growing fungal cultures are not mandatory for taxonomic description.

Enzymes of foliicolous fungi:

The leaf surfaces, which come in contact with environment, consist of non-cellular cuticles that are non-living and heterogeneous in chemical nature. Major components include lipid, cutin, cellulose and pectin. In addition, waxes are deposited outside the cuticle. Penetration into plant tissue depends upon the ability of fungi to produce enzymes such as cutinases, pectinases, cellulases and lipases, which are necessary to degrade plant polymers such as cutin, pectin, cellulose, lipids and waxes, respectively. The high capacity of enzyme secretion enables fungi to be the primary colonizers of plant substrates (Agrios, 1997).

Enzymes such as pectinases play major role in fruit development, ripening and cell wall extension (Fogarty and Kelly, 1990). They also have application in food industry. Lipases are ubiquitous enzymes of considerable physiological significance and industrial potential. They catalyze hydrolysis of triacylglycerols to glycerol and free fatty acids (Balashev et al., 2001). Lipases occur widely in animals, plants and microorganisms. Since microbial extracellular lipases are usually more thermostable than animal or plant lipases, they have received much attention with respect to their

free fatty acids (Balashev et al., 2001). Lipases occur widely in animals, plants and microorganisms. Since microbial extracellular lipases are usually more thermostable than animal or plant lipases, they have received much attention with respect to their wide use in diagnostics, food and food additives, paper pulp, dairy, detergent, cosmetic, pharmaceuticals and tanning industries (Margesin et al., 2002; Marek & Bednarski 1996; Kazlauskas and Bornscheuer, 1998; Takamoto et al., 2001). Unfortunately, investigations on enzyme production by foliicolous fungi have so far been very rare.

CHAPTER III

MATERIALS AND METHODS

This investigation, aimed at studies on diversity, ecology and biology of foliicolous fungi from Goa and neighbouring areas of Maharashtra and Karnataka, was carried out during the period from January 2003 to August 2005.

The study site and vegetation:

All the 11 talukas in the State of Goa, Sawantwadi of Maharashtra and Belgaum, Hubli and Karwar talukas of Karnataka were considered while sampling of and researches on foliicolous fungi. Collection localities are marked in the Map 1. Geographically located along the West Coast of Indian peninsula and demarcated by Terekhol river in the north, river Kali in the south, Western Ghats along the east and Arabian Sea in the west, Goa covers an area of 3,702 km². The State lies between the latitudes 15°48'00" N to 14°53'54" N and longitudes 74° 20'13" E to 73° 40'33" E. Being coastal, Goa has a marine climate with moderate temperatures (20°C - 35°C) and fairly high humidity (65 - 90%) round the year. The southwest monsoon brings copious amount of rain between June and September, the annual rainfall is from 280 to 320 cm (Pascal, 1988; Saldanha, 2001).

About one-fourth of Goa, the foothills of Western Ghat slopes in the talukas of Sanguem, Sattari, Canacona and Quepem and to a lesser extent in the talukas of Ponda, Pernem and Bicholim, is under forest cover. Many types of commercial tree species thrive in the well-aerated soils on the foothills where, lateritic soil is mixed with humus to form loamy soil, which favours thick and high growth of plants. The coastal talukas of Tiswadi, Bardez and Salcete have scrub jungles. Besides, the land is covered by varied vegetation including plantations of coconut, cashew, areca, guava, and other fruit trees interspersed by extensive paddy fields. According to Rao (1986), vegetation of Goa can be broadly classified into following 3 groups: Coastal estuarine

vegetation consisting of mostly mangrove species; plateau vegetation confined especially to the low altitude of the ghats; and, moist deciduous, semi-evergreen and evergreen forest patches limited to higher altitude slopes of the ghats.

(i) Coastal estuarine vegetation of mangroves is extended along the swampy riverbanks: Topographically, the coastline is interspersed by estuaries, mangroves, swamps and khazan lands (Rao, 1986). Botanically, this zone is characterized by peculiar root formations like stilt roots of *Rhizophora*, pneumatophores in *Avicennia*, knee knot roots in *Bruguiera*, etc. These trees are present mostly in sheltered bays and found in areas covered by salt or brackish water at high tidal streams and borders of estuaries more or less protected against heavy wave action and winds. Most of the coastal regions of Goa are rocky with projecting ridges as well as rocky boulders and consequently the strand vegetation is limited to few patches of narrow strips bordering the Arabian Sea.

(ii) Vegetation along the undulating terrains and hill plateaus: Extending into interior, the land has undulating terrains and small hills eventually ending up in tabletop plateau. These are part of the Western Ghat or Sahyadri hill ranges. The hills range between 50-200 MSL, often accommodate between them, bowl-like depressions. Several long and short, seasonal streams and perennial rivers flow along the ghats. The undulating terrains of ghats show 3 types of vegetation: Open scrub jungle intermixed with tall trees in the bowl-like depressions, grasslands interspersed with tall or stunted trees on the plateaus and moist deciduous forests along the sloppy hills.

(iii) The scrub jungle interspersed with woody trees is seen from Panaji to Cortalim and Margao and from Bicholim to Sanquelim. *Anacardium occidentale* is cultivated on an extensive scale. Several eroded wastelands sustain patchy vegetation composed

of dry deciduous elements such as species of *Acacia*, *Albizia*, *Calotropis*, *Calycopterus*, *Carissa*, *Fruticosa*, *Grewia*, *Holarrhena*, *Ixora*, *Lantana*, *Terminalia*, *Vitex*, *Woodfordia*, etc. The moist mixed deciduous forests, the main forest type of Goa, cover more than half of the wooded area. This type of forests occurs around Tudal, Ordofond, Butpal, Molem, Codal, Ambiche Gol, Anmod Ghat and Canacona. Predominant woody species seen are *Adina cordifolia*, *Albizia lebbek*, *A. procera*, *Dillenia pentagyna*, *Holoptelea integrifolia*, *Lagerstroemia parviflora*, *Mallotus philippensis*, *Mitragyna parvifolia*, *Semecarpus anacardium*, *Stereospermum colais*, *Terminalia crenulata*, *T. bellerica*, *T. paniculata* and *Trewia nidiflora*. Shift cultivation is common in these places. *Caryota urens* is the common wild palm seen here. In the second story, *Strobilanthes callosus*, *Elaeagnus conferta* and *Capparis* spp. are found. The semi-evergreen and evergreen vegetation are seen along the upper ghats, mostly above 500 m, bordering the contiguous forests of Ratnagiri district in the north and Uttara Kannada District in the south. This forest-type occurs at Ambiche gol, Molem, Butpal and Nadquem, species composition being *Artocarpus hirsutus*, *A. gomezianus*, *Calophyllum* spp., *Diospyros montana*, *Garcinia indica*, *Lagerstroemia microcarpa*, *Kydia calycina*, *Macaranga peltata*, *Pterospermum diversifolium* and *Sterculia guttata*. Evergreen forest type is seen in Ponda-Amboli-Ramghat belt, the species composition being *Artocarpus gomezianus*, *Calophyllum calaba*, *Canarium strictum*, *Carallia brachiata*, *Chroisophyllum acuminata*, *Diospirus ebumum*, *Ficus* spp., *Garcinia gummi-gutta*, *G. indica*, *Hopea ponga*, *Holigarna arnotiana*, *Hydnocarpus pentendra*, *Litsea coriacea*, *Lophopetalum wightianum*, *Knema attenuata*, *Mallotus philippensis*, *Mangifera indica*, *Mimusops elengi*, *Myristica* spp., *Olea diocia*, *Palaquium ellipticum*, *Persea macrantha* and *Syzygium cumini*.

This varied vegetation and plant species diversity offered extensive and wonderful opportunity for collecting samples of foliicolous fungi.

Field survey and collection of samples:

As indicated in Map 1, a number of locations in Goa and bordering talukas of Maharashtra and Karnataka were visited at frequent intervals, in all seasons, from January 2003 to August 2005, to source fungal samples. Samples were gathered from different ecological niches supporting diverse flora and vegetation types.

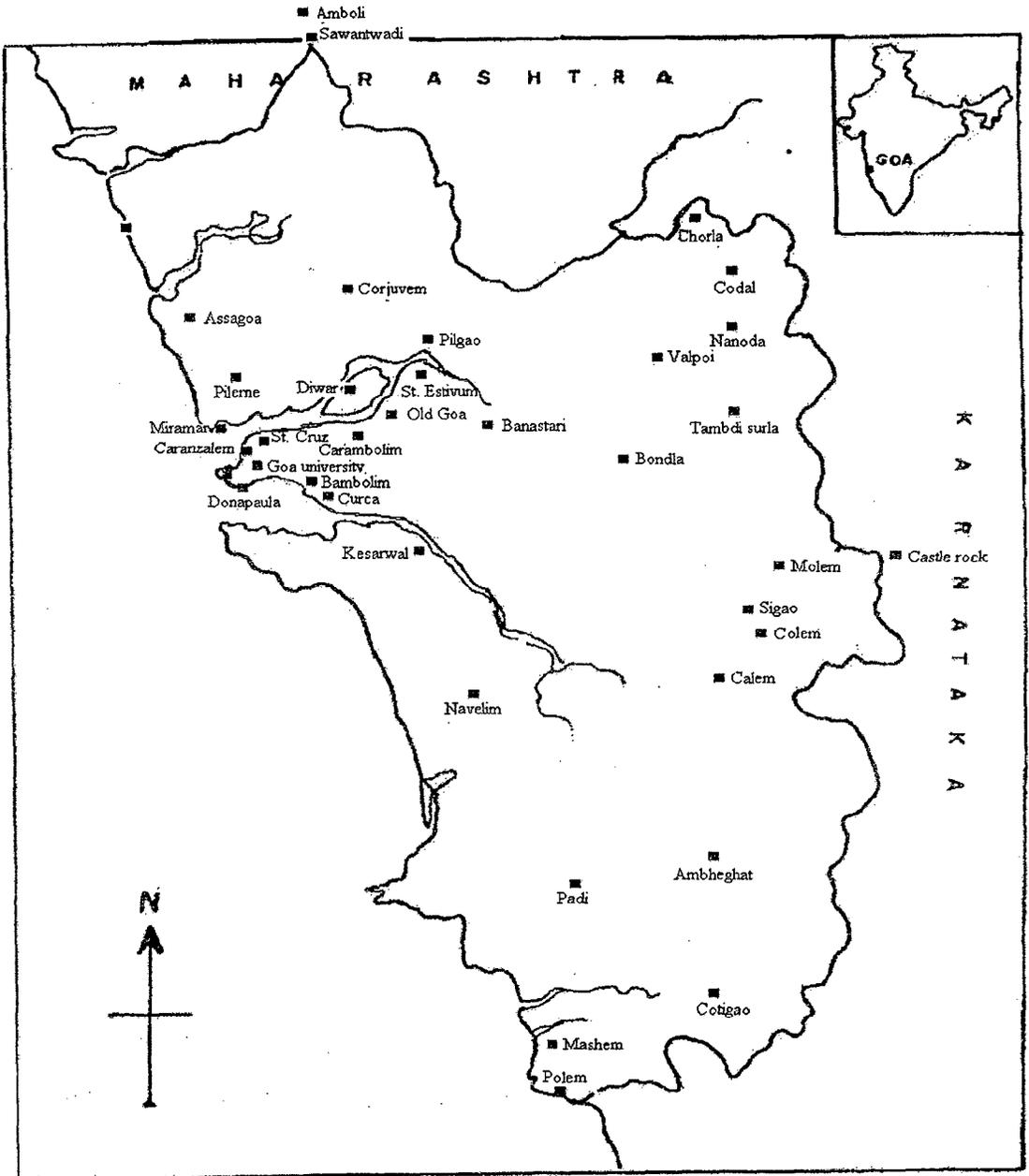
Field gear and collection of samples

In all collection trips, needful tools such as hand lens, scissors, polythene bags, rubber bands, naphthalene pellets, thermometer, notebook, etc. were always carried along with. Localities and sites visited included forested areas, plantations, vegetable fields, private farms, wild ground vegetation and occasionally treetops.

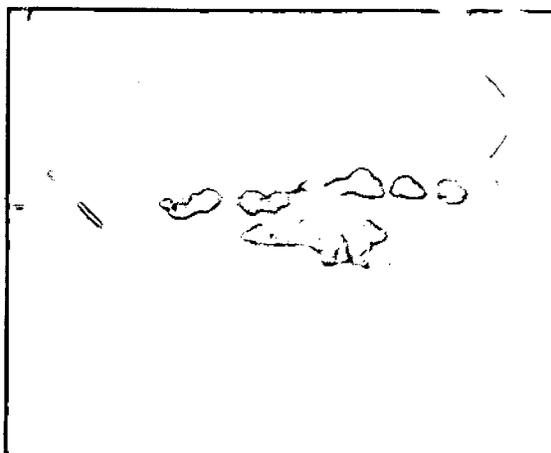
In the present study, dicot as well as monocot plants were considered equally for collecting foliicolous fungi. The samples included live, senescing and moribund leaves with some kind of infections. The leaves with infection were plucked from herbaceous plants, bushes, climbers and tree plants and brought to the laboratory in separate collection bags. Each sample with manifestation of foliicolous fungi was sorted out.

On sampling, each specimen was kept in separate polythene bag with a collection number. Relevant information such as symptoms, scientific name of the plant, locality and date of collection, was recorded in the field diary. On bringing the materials to the laboratory, each specimen was divided into two sets: one, for immediate observation and preparation of microscopic slides and the second, for preservation as herbarium specimen.

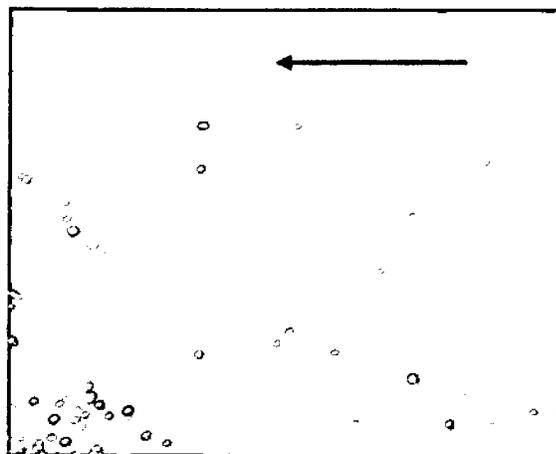
Map 1: Map of Goa and neighbouring areas from Maharashtra and Karnataka showing collection sites.



Each specimen was examined carefully when fresh, by naked eye and under the stereomicroscope, for symptomology and colony characteristics of the foliicolous fungus. The fungal material was then picked up with a fine-tipped needle, placed on a clean slide with a drop of distilled water or lactophenol mountant and observed under the microscope. Detailed study of morpho-taxonomic characteristics of the fungus was further done under compound microscope.



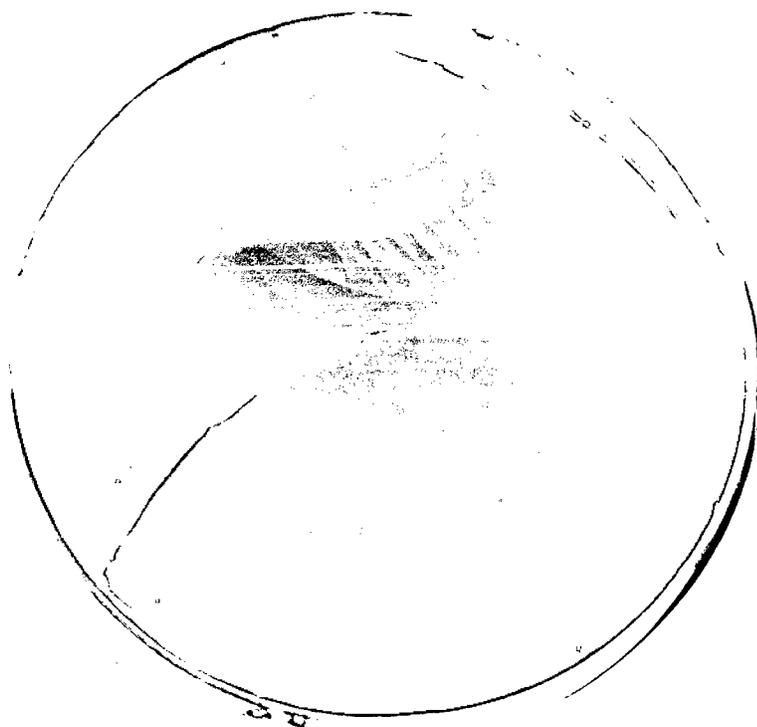
Direct observation of leaf surface



Observation of fungus under stereomicroscope
(Arrow points to the fungus)

Observation after moist chamber incubation:

If the symptom does not exhibit the presence of associative fungus, the sample was subjected to moist chamber incubation, to provide a conducive humid environment for the fungus to grow and sporulate (Hawksworth, 1974). For this, a thin layer of absorbent cotton superimposed by a circular piece of blotting paper was placed in a Petri plate (20 cm diam.) and soaked with distilled water. Excess water was drained off. Four clean microslides were placed on the surface of the filter paper. The plates were sterilized at 121⁰C and 15 lbs/cm³ pressure in an autoclave for 20 minutes. Fresh leaves with symptoms were thoroughly washed with sterile distilled water, placed in sterilized moist plates and incubated at room temperature. From third day onwards, the incubated leaves were scanned under stereomicroscope for growth of fungus. The growing fungal colony was picked up and mounted on a slide containing a drop of distilled water or lactophenol.



Moist chamber incubation

Slide mounts for microscopic observation:

Fungal material was carefully scrapped from infected leaf material with a flame sterilized, fine tipped needle and mounted on a clean slide containing either a drop of lactophenol or distilled water. Cotton blue stain in lactophenol was used for hyaline fungi. The mounted slide was gently warmed over a spirit lamp to eliminate the air bubbles from the slide preparation. Excess stain, if any, was removed with help of a blotting paper and edges of the slide sealed using DPX.

The semi-permanent slides with sporulating structures such as conidiophores, conidiogenous cells and conidia (Hyphomycetes); pycnidia or acervuli, conidiogenous cells and conidia (Coelomycetes) and ascocarp, asci and ascospores (Ascomycetes) were observed under a compound microscope (Olympus series, CH30) for detailed information. These formed the diagnostic characters of the fungi and further aided in their identification. Diagrammatic illustration of every fungus with all morphological

details was made under different magnifications using a camera lucida drawing tube. Photomicrographs were made using an Olympus DP12 digital camera fitted to an Olympus BX41 microscope. Sporulating structures such as conidiophores and conidia in case of Hyphomycetes, pycnidia, conidiogenous cells and conidia in case of Coelomycetes and ascocarp, asci and ascospores in Ascomycetes were considered as diagnostic features in the identification of fungi.

Using appropriate reference literature, the isolates were identified and assigned to respective genera and species. The descriptions of fungi were written in a standard mycological diagnostic format (Hawksworth et al. 1995).

Preservation of specimens:

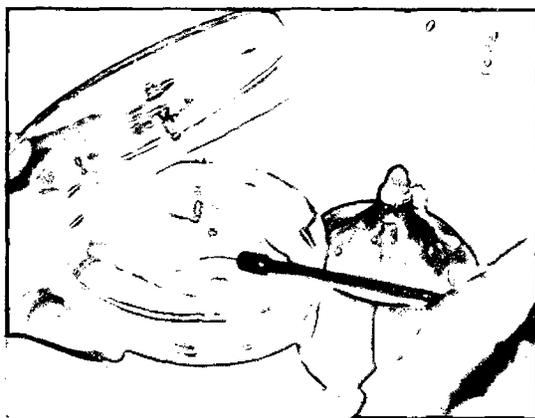
The specimens were pressed between two dry sheets of blotting papers or newspapers in a herbarium press. The papers were changed daily and the pressed specimens were exposed to sun heat for a day. Completely dried specimens were stored in paper envelopes with a piece of naphthalene pellet to avoid mite and insect invasion.

Culturing of foliicolous fungi:

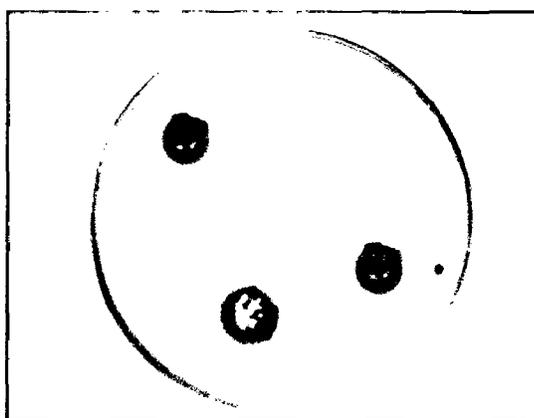
Efforts were made to isolate the foliicolous fungi in culture. Two methods, 'single spore isolation method' (Kendrick, 1979) and 'infected tissue plating method' (Hawksworth, 1974), were employed in the present study:

i) Single spore isolation method: Infected leaves, directly or after incubation in a moist chamber, were scanned under stereomicroscope and a sterile needle was allowed to touch the spore-producing organ, conidiophore, ascocarp or pycnidium, of the growing fungus. Several spores get attached to the loop due to tenacity. A drop of sterile distilled water was taken on a clean flame-sterilized slide and a loop load of

spore mass was placed in it. The soaked spores were spread on a petri plate containing either 2% malt extract agar or leaf extract agar medium. On the subsequent day, as and when individual spores germinate, a small block of agar with mycelium was cut and transferred on to an agar slant to maintain a pure culture of the fungus.

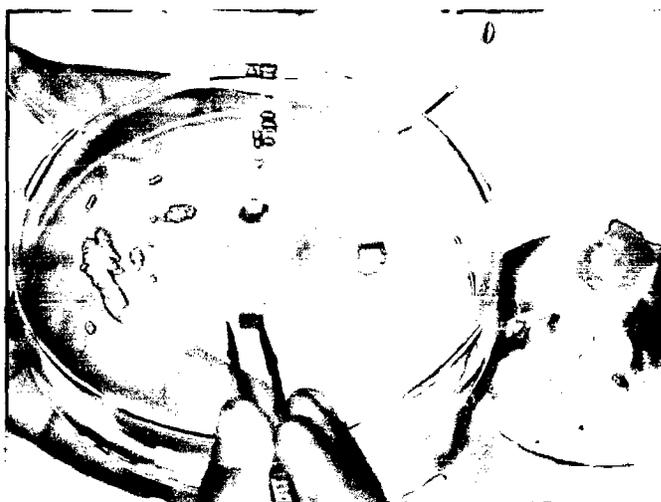


Inoculation of single spore



Appearance of fungal colonies after 7 days

ii) Infected tissue-plating technique: The leaf spot along with its margin was cut off the fresh leaf and placed in 0.5% sodium hypochlorite solution for 30 seconds. The infected tissue was thoroughly rinsed in sterile distilled water and plated in Petri plate containing 2% potato dextrose agar medium. The growth of fungus was observed generally between 3rd and 7th day. A small block of the growing colony was cut and transferred to an agar slant and maintained in cold temperature (4-8^oC).



Infected tissue-plating technique

Media used for isolation and maintenance of fungi:

Malt extract (2%) agar, Potato dextrose (2%) agar and Leaf extract (10%) agar media were used in the present study for isolation of foliicolous fungi. A mixture of antibiotics containing bacitracin 0.02 g, neomycin, 0.02 g, penicillin G 0.02 g, streptomycin sulphate 0.02 g and tetracycline 0.02 g, dissolved in 10 ml sterile distilled water and filter sterilized was added to the 1 L medium.

- (i) Malt extract agar (MEA) medium: Dehydrated malt extract (5 g) and agar (20 g) (HiMedia Pvt. Ltd., Mumbai) were dissolved in 1 L distilled water; the pH was adjusted to 5.5 and sterilized in an autoclave at 121⁰C for 20 min under 15 lb/cm³ pressure.
- (ii) Potato dextrose agar (PDA) medium: Potato dextrose agar, 41.0 g (HiMedia Pvt. Ltd., Mumbai), was dissolved in 1 L distilled water. The pH of the medium was adjusted to 5.5 and sterilized in autoclave at 121⁰C for 20 min. at 15 lb/cm³ pressure.
- (iii) Leaf extract agar medium: 100 g of leaves were boiled in 1 L distilled water for 30 min., filtered using muslin cloth and 20 g of agar was dissolved to the filtrate. The volume was adjusted to 1 L and pH to 5.5. The medium was sterilized in an autoclave at 121⁰C for 20 min. at 15 lbs./cm³ pressure.

Isolated fungi were maintained in MEA slants under sterile paraffin oil in room temperature (24-35⁰C). Duplicate cultures were maintained in eppendorf tubes in the refrigerator (4⁰C). These are the standard culture preservation methods adopted at Goa University Fungus Culture Collection Unit (GUFCC) wherein the foliicolous fungal isolates were permanently lodged with specific GUFCC accession numbers.

Observation of cultural characters:

Cultural characters such as colony shape, size, margin, texture and colour of the isolated fungi were recorded after 7 days of inoculation. Standard colour charts and descriptive terminologies (Hawksworth et al., 1995) were used while describing the colony characters.

Study of host specificity:

To examine the extent of 'host-association specificity' of foliicolous fungi vis-à-vis the plant host, a simple method was adopted. Infected leaves of a particular plant species showing similar symptoms were collected from 10 distantly located places during the tenure of the study. Leaf spots and the causal foliicolous fungus were studied microscopically for each sample. If the same fungus, with similar symptom, was recorded from different places, in the range of 30-50%, it was assumed that the fungus might be specific to the host plant. Specificity of foliicolous fungi to their hosts (%) was calculated as follows:

$$\frac{\text{No. of times fungus isolated}}{\text{No. of samples collected}} \times 100$$

Though 'Koch's Postulates' (Rangaswamy, 1998) were ideal to confirm the host specificity of the fungi, this method was not attempted in this work.

Enzyme assay:

The isolated foliicolous fungi were screened for production of 3 degradative enzymes, viz. pectinase, cellulase and lipase, in order to examine their infectivity nature in plants. These enzymes are also known for their varied industrial applications. The methods described by Hankin and Anagnostakis (1975) for

pectinase, Carder (1986) for cellulase, and Sztajar et al. (1988) for lipase were followed. The test fungus was grown on malt extract agar medium in a Petri plate for 7 days at room temperature (28-32⁰C); colony discs of 5 mm size were cut and used as initial inoculum for enzyme assay.

(i) Pectinolytic activity: To detect the production of pectate lyase enzyme, pectin agar medium was used. The composition of the medium is as follows: Agar 15 g/l, yeast extract 1g, pectin 5g per litre of mineral salt solution. The mineral salt solution contain per 500 ml: (NH₄)₂SO₄, 1g; KH₂PO₄, 2g; Na₂HPO₄, 3g; FeSO₄.7H₂O, 0.1g; CaCl₂, 0.5g, H₃BO₃, 5µg; MnSO₄, 5µg; ZnSO₄, 35µg; CuSO₄, 25µg; MoO₃, 5µg; pH 7. The plates were incubated for 5-7 days and flooded with 1% Cetrinide (Cetyltrimethyl-ammonium bromide). The Cetrinide precipitates the intact pectin in the medium and the pectin utilized is revealed as clear zones around active colonies in an otherwise opaque medium (Hankin and Anagnostakis, 1975).

(ii) Cellulolytic activity: To detect the production of cellulase, Carboxymethylcellulose has been used. The composition of the test medium is as follows: Agar 20g/l, Carboxymethylcellulose 10g. The mineral salt solution contain per 500ml: (NH₄)₂SO₄, 1g; KH₂PO₄, 2g; Na₂HPO₄, 3g; FeSO₄.7H₂O, 0.1g; CaCl₂, 0.5g, H₃BO₃, 5µg; MnSO₄, 5µg; ZnSO₄, 35µg; CuSO₄, 25µg; MoO₃, 5µg; pH 6. After seven days of incubation, the plates were flooded with 0.1% Congo red solution. A clear zone in positive colonies indicated cellulase production (Carder, 1986). The plates were subsequently flooded with 20 ml of 1N NaCl to allow the clearance zone to remain for a longer duration (Hankin and Anagnostakis, 1975).

Lipolytic activity: Medium containing tributyrin was used to detect the production of lipase activity. Screening of lipolytic fungi was carried out on solid medium consisting of the following : 0.5 % peptone, 0.3 % yeast extract, 1 % agar and

0.1 ml tributyrin. The pH was adjusted to 5.5. Tributyrin was sterilized using sterile membrane filtration unit. Lipolytic activity was determined on the basis of extent of enzyme diffusion zone after 5 days of incubation (Sztajer et al., 1988).

CHAPTER IV
RESULTS AND
DISCUSSION

RESULTS

Foliicolous fungi of India have been isolated, documented and studied independently by several students of mycology, in the past. While some credible floristic data is now available from some regions of the country, especially the North-Eastern forests including Nepal (Kamal *et al.* 1993), foliicolous fungi have not been investigated in any detail from the forests of Western Ghats belt. The only notable work available of Hosagoudar (2002) however, has concentrated mostly on Meliolales of southern India.

In the present study, fungi occurring on living leaves of angiosperm (both dicot and monocot) plant species have been collected and studied in detail from 42 localities from the State of Goa and adjoining areas of Karnataka and Maharashtra. The localities have been visited once or more, during the study period. The number of samples collected, host plants scanned and fungi isolated from these plants and places are given in Table 1, 2 and 3. In all, 202 fungi were isolated from 1725 samples gathered. Of these, 50 were brought into culture.

In this Chapter, results are presented in 3 parts:

Part I: Taxonomy and diversity of foliicolous fungi associated with different plant species of Goa and neighbouring regions of Maharashtra and Karnataka.

Part II: Specificity of foliicolous fungi with their host plants

Part III: Enzyme activities of foliicolous fungi recovered in culture.

Part I: Taxonomy and diversity of foliicolous fungi associated with different plant species.

Diverse habitats have been visited for collection of fungal samples. These include, grassland plateaus, deciduous and semi-deciduous forests, evergreen sholas, scrub jungles and cultivated plantations all across the State of Goa and adjoining regions. Observation of fresh infected leaf samples directly under the microscope and subsequent to moist chamber incubation were the two prime methods employed for isolation of fungi.

These exercises resulted with the isolation of 202 taxa of foliicolous fungi assignable to 78 genera of which 47 were brought into culture. The fungi obtained were categorized into Hyphomycetes (166 species in 66 genera), Coelomycetes (8 species in 7 genera), Ascomycetes (7 species in 5 genera) and undetermined forms [(Hyphomycetes (11), Coelomycetes (4) and Ascomycetes (6)]. The undetermined taxa in this thesis were resulted due to nonavailability of adequate reference material immediately for identification and some isolates remained nonsporulating even after prolonged incubation. As can be seen, Hyphomycetes are the largest group encountered.

Diagnostic characters of microfungi such as morphology, colour and size of the colony and sporulating structures, such as ascomata, asci and ascospores in case of Ascomycotina and conidiomata, conidiophores and conidia in case of Deuteromycotina, formed the basis for identification. Detailed description along with information of specimens examined is given for each species in the text, along with camera lucida illustrations and photomicrographs wherever possible.

The description of the species is based on definite specimen, material or culture of the fungus, as prescribed in the International Code of Botanical

Nomenclature (Hawksworth, 1974). Representative pure culture of each taxonomic entity (identified fungal species or morphotype) from each sample was properly labeled and maintained in the repository of 'Goa University Fungus Culture Collection' (GUFCC). Dried specimen and microslides containing fungal diagnostic structures on which the description is based was prepared, properly sealed, labeled, and maintained in Herbarium of Botany Department, Goa University (GUBH).

Diagnoses of the new taxa are given along with description of holotypes. At this stage, only the names are latinised in the text. In the absence of Latin diagnosis of the entire description, as per Article 36 of the International Code of Botanical Nomenclature, the novelty of these taxa presently remains only provisional. As and when the new taxa are being published, the diagnosis will be latinised.

Index Fungorum of CABI Bioscience (<http://www.indexfungorum.org>) and Systematic Botany and Mycology Laboratory Database (<http://nt.ars-grin.gov/fungaldatabases/fungushost>) were cross-referred at every step to analyse and confirm the floristic data obtained on foicolous fungi of the region under study.

Taxonomic Part

A. Hyphomycetes:

1. *Acremonium* sp.

(Fig.1a-c; 1d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey, semicircular to rectangular, 2-4 mm wide, only few spots were observed on some leaves of the plant. *Colonies* on leaf spots effuse, grey, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, septate, branched, hyaline, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, branched, septate,

smooth, hyaline, 40-65 x 2-4.5 μm . *Conidiogenous cells* monophialidic, terminal, integrated, smooth, 30-40 x 2-3 μm . *Conidia* solitary, aggregating in slimy heads at the tip of phialide, simple, endogenous, hyaline, cylindrical, rounded at both the ends, 6-9 x 2-3.5 μm .

Specimen examined: On living leaves of *Calycopteris floribunda* Lamk. (Combretaceae), Colem, Sanguem, Goa, 16/01/05, Pratibha, J., Herb. No. GUBH-P194; Culture No. GUFCC No. 4901

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.1 cm in 7 days, circular, floccose, slimy, off-white, margin wavy, reverse yellowish.

2. *Acroconidiellina arecae* (Berk. & Br.) Ellis, 1971. *Mycol. Pap.* 125: 26

(Fig.2a-c; 2d)

Fungus Hyphomycete. *Lesions* epigenous, black, formed superficially on the surface of the leaf, do not penetrate the host tissues. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* superficial, composed of thin, thin walled, smooth, branched, olivaceous brown, 2-4 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in dense fascicles, erect, straight, unbranched, septate, thick walled, verrucose, dark brown to almost black, 60-250 x 5-9 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate. *Conidia* solitary, simple, acrogenous, dark brown, 3-4 septate, with central cell verrucose and darker than the peripheral cells, 30-75 x 18-22 μm with thickened and darkened hilum.

Specimen examined: On living leaves of *Areca catechu* Linn. (Arecaceae), Colem, Sanguem Goa, 03/09/03, Herb. GUBH No. P70; Paryem, Sattari Goa, 02/07/04, Herb. GUBH No. P70; Calem, Sanguem Goa, 14/10/04, Herb. GUBH No. P70; Mashem, Cancona Goa, 16/10/04, Pratibha, J. Herb. GUBH No. P70. Culture No. GUFCC No. 4902

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 1.0 cm in 7 days, circular, off-white, flat, margin smooth, reverse off-white.

This fungus is most common on mature green and senescent leaves of *Areca catechu* in almost all areca-cultivated plantations in Goa and Karnataka. This is also one of the recognizable host-specific foliicolous species. *Zeuctomorpha arecae* Sivan., Kirk & Govindu often known to occur along with the conidial state, is the teleomorph of *Acroconidiellina arecae* (Sivanesan, 1984).

3. *Acrophialophora indica* Pratibha et Bhat sp. nov. (Fig.3a-c; 3d)

Fungus Hyphomycete. *Leaf spots* amphigenous, pale brown, irregular, observed mostly at the tip of the leaf. *Colonies* on leaf spots effuse, brown, velvety. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, thin walled, 1.5-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, unbranched, pluriseptate, light olivaceous at the base, hyaline towards the tip, verrucose, with verticillately arranged phialide at the apical region, 112-682 x 3-5 μm . *Conidiogenous cells* monophialidic, discrete, arranged singly, in pairs or in verticillis, lageniform, smooth, hyaline, 8-23 μm long, 3-5 μm wide at the base, 1.5-2.5 μm at the tip. *Conidia* solitary, simple, hyaline, smooth, aseptate, ellipsoidal, 5-8 x 1.5-2.5 μm .

Holotype: On living leaves of *Tabernaemontana coronaria* (Jacq.) Willd. (Apocynaceae), Banastari, Ponda Goa, 15/03/03, Pratibha, J., Herb. No. GUBH P24.

The phialidic genus *Acrophialophora* is monotypic (Mohsen et al., 2000). The shape and size of conidiophores and conidia in *A. indica* distinctly differ from that of the type species, *A. fusispora* (Saksena) Ellis comb. nov. In *A. fusispora* the

LEGENDS TO FIGURES

Fig. 1a-c: *Acremonium* sp.

1a- Leaf spots

1b- Conidiomata

1c- Conidiophores with conidia

Fig. 2a-c: *Acroconidiellina arecae*

2a- Leaf spots

2b- Conidiophores with conidia

2c- Conidium

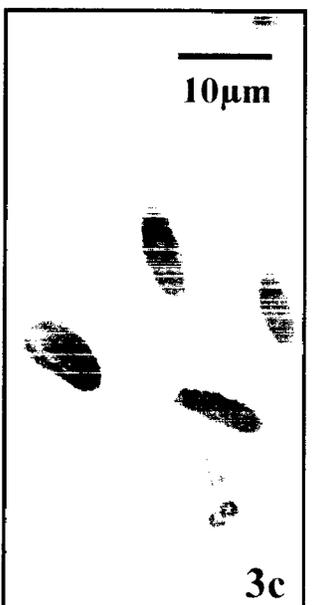
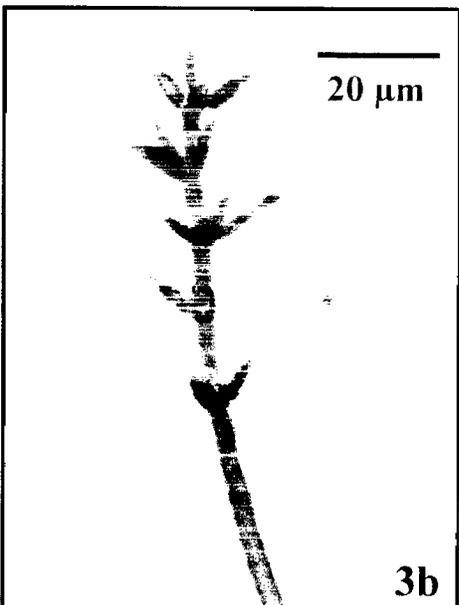
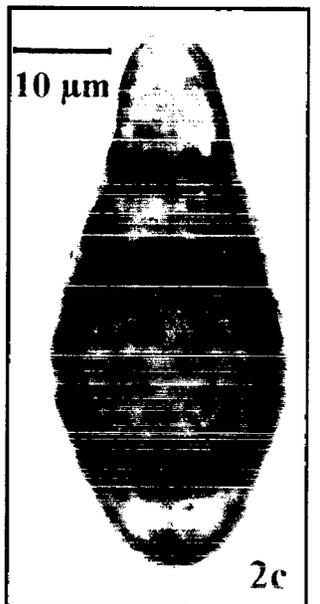
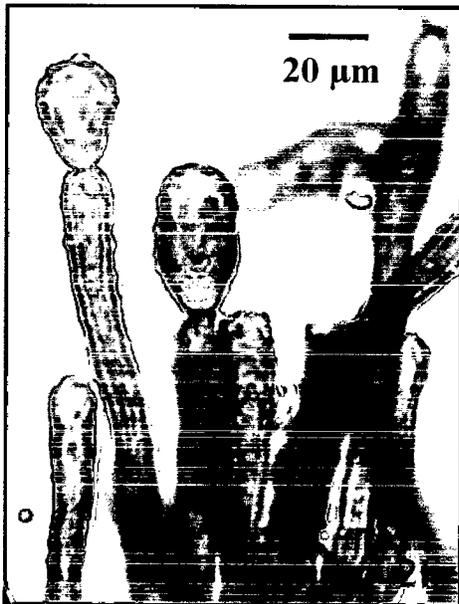
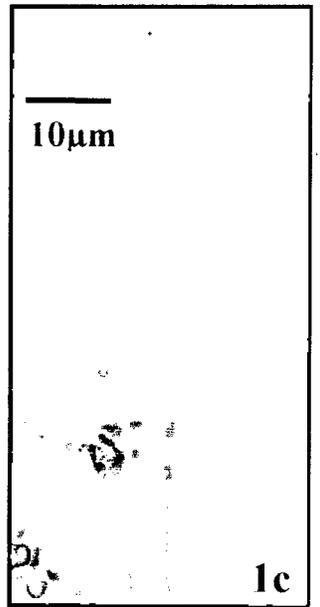
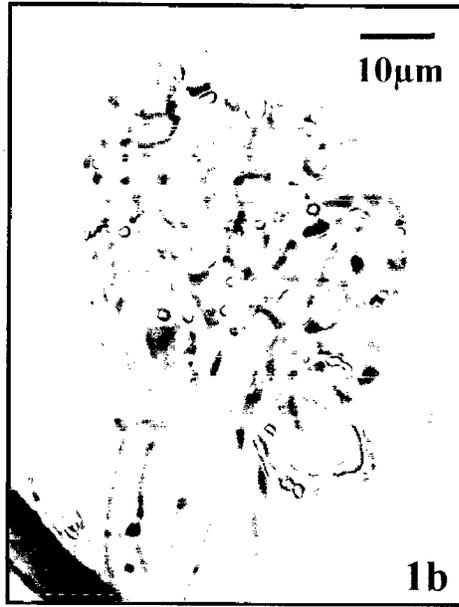
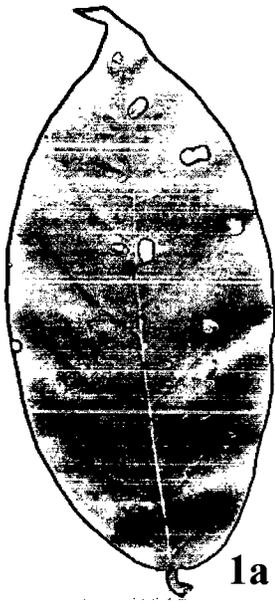
Fig. 3a-c: *Acrophialophora indica*

3a- Leaf spots

3b- Conidiomata

3c- Conidia

Fig. 1-3



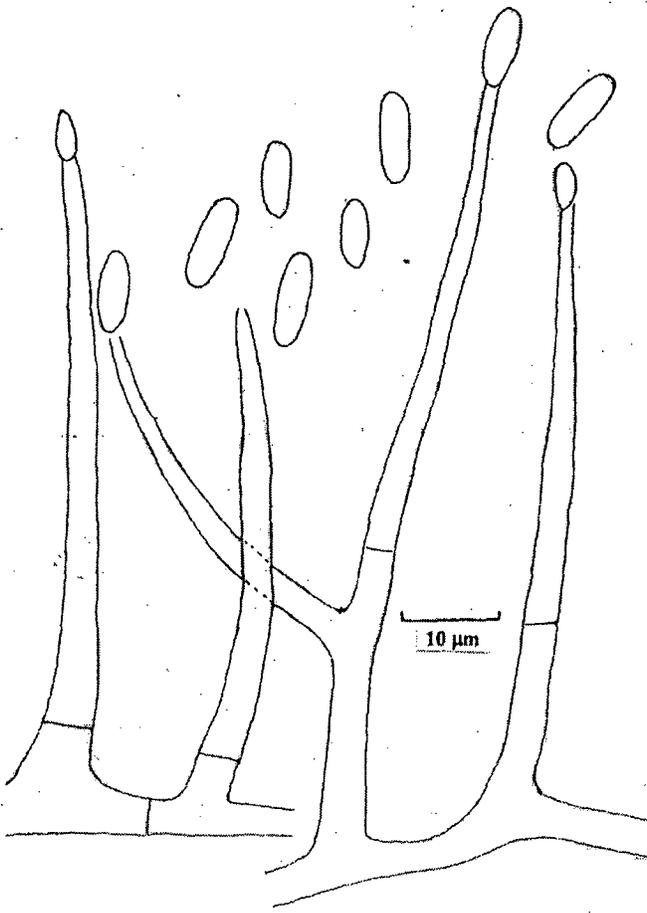


Fig. 1d *Acromonium* sp.

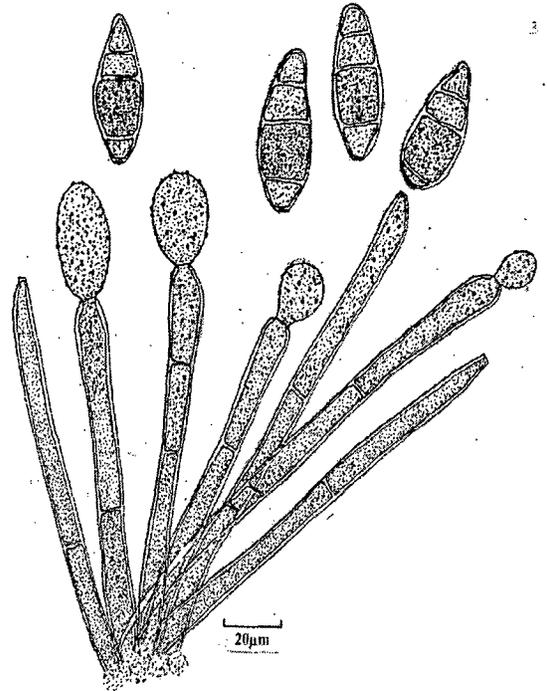


Fig. 2d *Acroconidiellina arecae*



Fig. 3d *Acrophialophora indica*

conidiophores and conidia are upto 1.5 mm long, 2-5 μm broad and 6-11 x 3.5-5 μm whereas in *A. indica* these are 112-682 x 3-5 μm and 5-8 x 1.5-2.5 μm . In *A. fusispora* conidia are slightly verrucose and with distinct spiral bands, where as in *A. indica* it is smooth and without any spiral bands.

4. *Alternaria longissima* Deighton & MacGarvie, 1968. *Mycol. Pap.* 113:10

(Fig.4a-c; 4d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, initially yellow, later becoming dark brown, 4-6 mm wide, central portion of the spot later collapses. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of branched, septate, thick walled, light brown, smooth, 3-4 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate as well as solitary, borne on superficial hyphae, erect, straight to slightly flexuous, unbranched, septate, smooth, brown, thick walled, sometimes slightly proliferating, 50-300 x 3-6 μm . *Conidiogenous cells* polytretic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, light brown, with thickened and darkened conidial scars. *Conidia* solitary, acropleurogenous, light olivaceous, smooth, pluriseptate, scolecosporous, acicular, 80-230 μm long, 7-8.5 μm wide at the broadest part, 2-3 μm thick at the pointed tip.

Specimen examined: On living leaves of *Urena lobata* Linn. (Malvaceae), Donapaula, Tiswadi, Goa, 13/11/03, Pratibha, J., Herb. No. GUBH P114.

5. *Alternaria tenuissima* (Kunze) Wiltshire, 1933. *Trans. Br. mycol. Soc.* 18: 157

(Fig.5a-c; 5d)

Fungus Hyphomycete. *Leaf spots* amphigenous, semi-circular to irregular, brown, 2.5-6.5 cm wide, only one or two spot were seen on one or two leaves of the tree. *Colonies* on leaf spots effuse, dark brown. *Mycelium* partly immersed, partly

superficial, composed of branched, septate, smooth, light brown, thick-walled, 2.5-4.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, arising singly or in fascicles, erect, straight to slightly flexuous, sometimes branched, septate, smooth, dark brown, 40-60 x 4-6 μm . *Conidiogenous cells* polytretic, integrated, terminal, later becoming intercalary, pale brown, sympodial, with conspicuous conidial scars 5.5- 25.5 x 1.5-3 μm . *Conidia* catenate, dry, simple, acropleurogenous, smooth, brown, with transverse and frequently oblique longitudinal septa, 45-102 x 12-27 μm , with thickened but not darkened hilum.

Specimen examined: On living leaves of *Ficus benghalensis* Linn. (Moraceae), University Campus, Taleigao Goa, 07/01/03, Pratibha, J., Herb. No. GUBH P7.

Species of *Alternaria* are generally considered as ubiquitous moulds. These fungi are seen associated with decaying plant litter, soil organic matter, stored seeds, ambient air, etc. (Ellis, 1971; 1976; Matsushima, 1971; 1975). *A. solani* (Ell. & Martin) Jones & Grout is the causal organism of early potato blight (Mehrotra and Aggarwal, 2003). This is the first record, *A. longissima* on *Urena* and *A. tenuissima* on *Ficus*, of occurrence of species of *Alternaria* as foliicolous.

6. *Ardhachandra selenoides* (Hoog) Subram. & Sudha, 1978. *Can. J. Bot.* 56(7): 731

(Fig.6a-c; 6d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grayish brown, irregular, large, covering almost half the leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* internal. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophore* macronematous, mononematous, solitary, arising from the hyphae, erect, straight to flexuous, unbranched, septate, smooth, light brown, 40-80 x 3-6 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, denticulate, 10-28 x

Fig. 4a-c: *Alternaria longissima*

4a- Leaf spots

4b- Conidiomata

4c- Conidium

Fig. 5a-c: *Alternaria tenuissima*

5a- Leaf spots

5b- Conidiophores and conidium

5c- Conidium

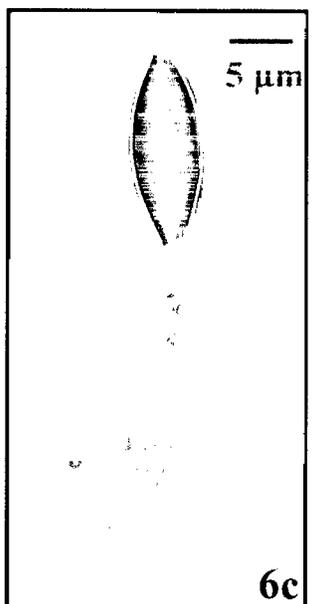
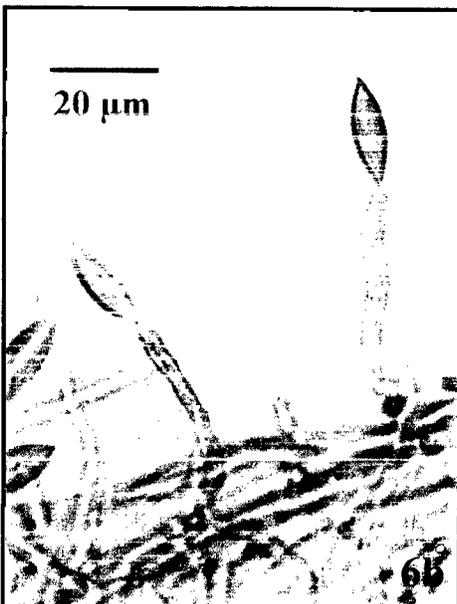
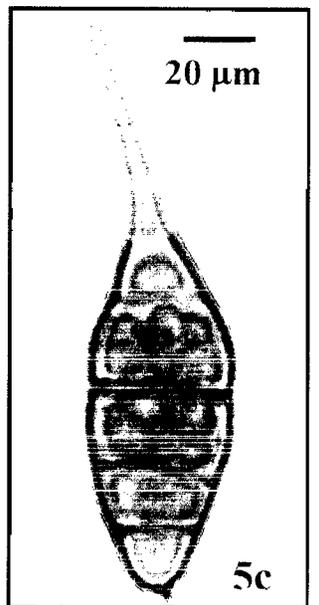
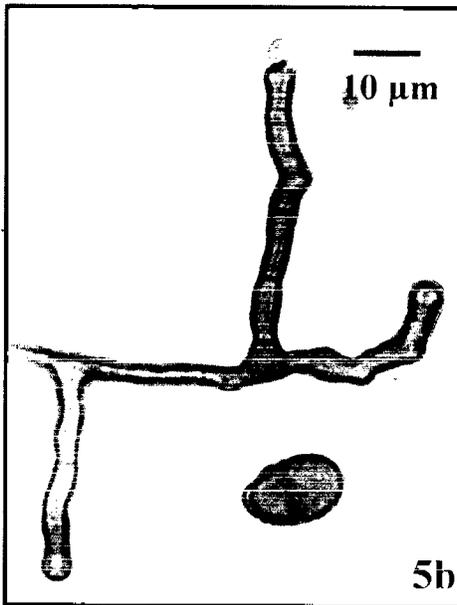
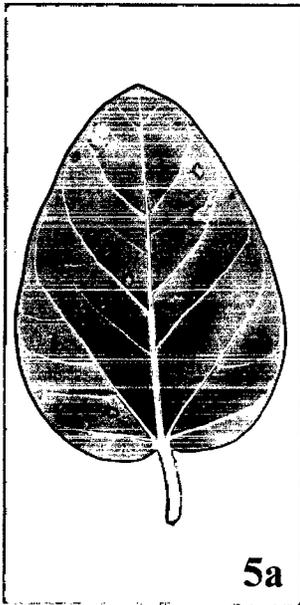
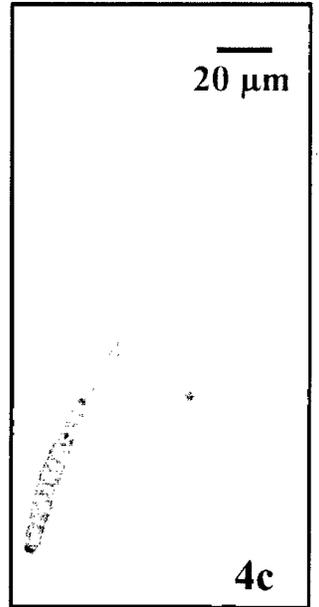
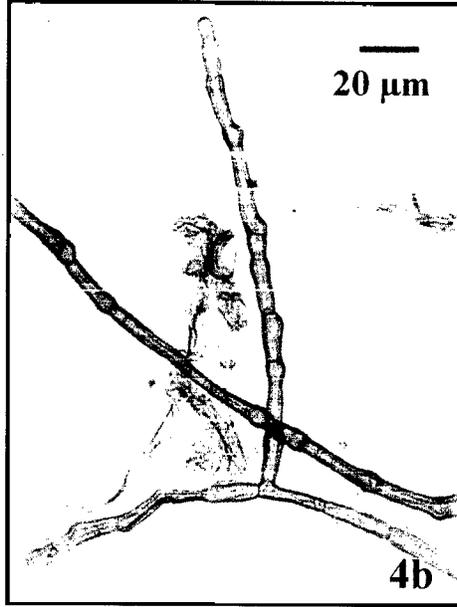
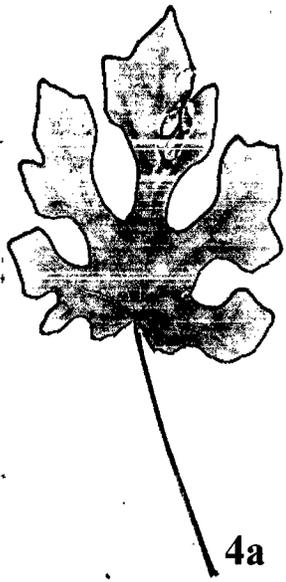
Fig. 6a-c: *Ardhachandra selenoides*

6a- Leaf spots

6b- Conidiomata

6c- Conidia

Fig. 4-6



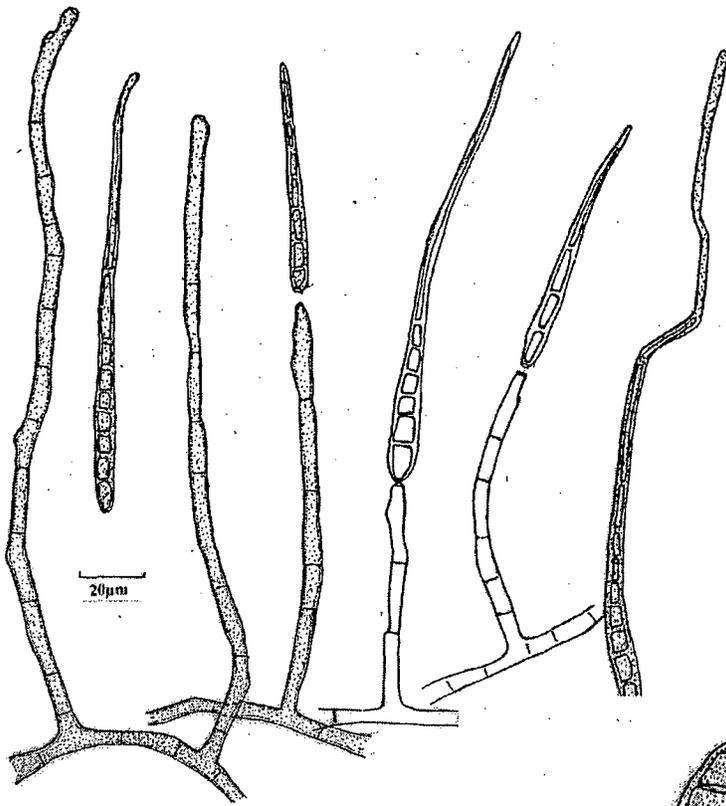


Fig. 4d *Alternaria longissima*

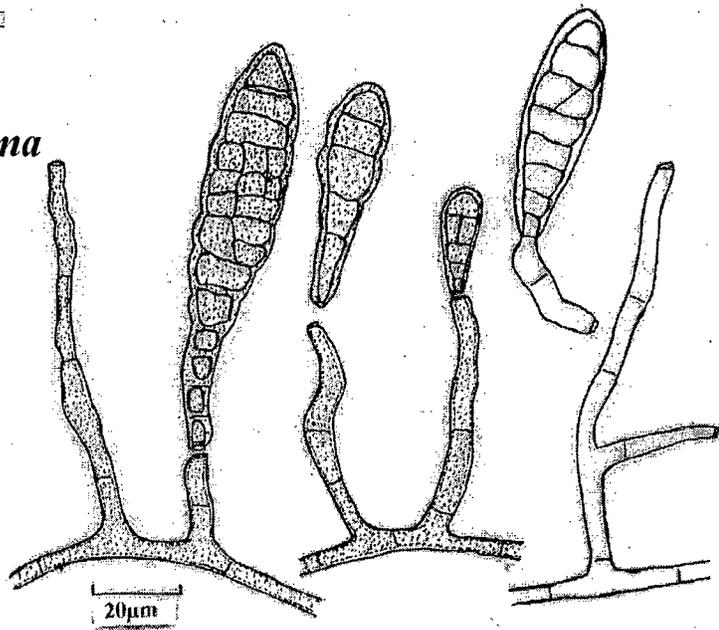


Fig. 5d *Alternaria tenuissima*

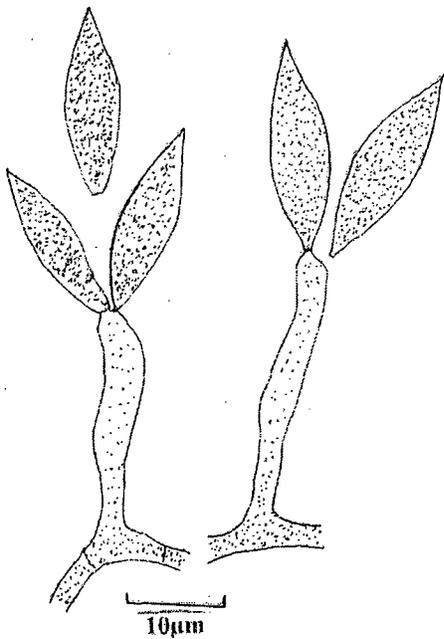


Fig. 6d *Ardhachandra selenoides*

3-4 μm . *Conidia* solitary, aseptate, smooth, fragile with pointed ends, 12.5-25.5 x 4.0-7 μm , yellowish with thick dark brown wall.

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Molem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P78.

A. selinoides has earlier been recorded as a saprophyte on varied plant litter (Subram. & Sudha, 1978). This is the first instance of the fungus being encountered as foliicolous.

7. *Bahusutrabeeja dwaya* Subram. & Bhat, 1977. *Can. J. Bot.*, 55(16): 2204

(Fig.8a-c; 8d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* partly immersed, partly superficial composed of thin, branched, septate, smooth, hyaline, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, dark brown, 100-380 x 6-9 μm . *Conidiogenous cells* monophialidic, terminal, integrated, light brown, smooth, with conspicuous colarrette, 60-87 x 6-8 μm . *Conidia* solitary, simple, endogenous, aseptate, spherical to obovoid, sub-hyaline, 12-16 μm .

Specimen examined: On living leaves of *Mallotus philippinensis* Muell. (Euphorbiaceae), Colem, Sanguem, Goa, 26/08/04, Pratibha, J., Herb. No. GUBH P168; Culture No. GUFCC No. 4904.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 9.0 cm in 7 days, circular, wooly, dark green, margin serrated, reverse black.

8. *Bahusutrabeeja manoharacharii* Pratibha & Bhat, 2006. In: *Emerging trends in Mycology Plant Pathology and Microbiol biotechnology*. BS publication. pp. 1-5.

(Fig.7a-c; 7d)

Fungus Hyphomycete. *Leaf spots* amphigenous, scattered, irregular to circular, dark brown with a black spot in the center, 4-6mm diam. *Colonies* on leaf spots effuse, dark brown, velvety. *Mycelium* partly immersed, partly superficial, composed of smooth, subhyaline, septate, branched, 2-2.5 μm wide hyphae. *Conidiophores* mononematous, erect, straight or flexuous, smooth, brown, thick-walled, 1-2-septate, unbranched, sometimes percurrently proliferating 1-2 times, 40-87.5 x 5.5-8.5 μm . *Conidiogenous cells* terminal, integrated, monophialidic, cylindrical, smooth, 25.5-50 x 5-8.5 μm , with flared conspicuous collarette. *Conidia* hyaline, thick-walled, angular, 0-septate, 9.5-11.5 x 7.5-9 μm , with fine hyaline setulae up to 4.5 μm long at each angulate end, aggregating into a slimy mass at the tip of the phialide.

Specimen examined: On living leaves of *Bridelia scandens* Roxb. (Euphorbiaceae), Chorle Ghat, Sattari, Goa, 02/07/04, Pratibha J., Herb. No. GUBH P143. Culture No. GUFCC No. 4903

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.3 cm in 7 days, circular, floccose, reddish brown margin serrated, reverse dark brown.

Two species of the genus *Bahusutrabeeja* Subram. & Bhat, of the so far described 5 species (McKenzie, 1997), have been reported here for the first time as 'foliicolous'. All these species are true litter-inhabiting fungi. A few of them, besides, have also been reported as endophytes (D'souza, 2002). Such plasticity in their ecological association, from saprophytic litter to foliicolous habitat through endophytism has relevance, both to host plant and the fungus (Santamaria and Bayman, 2005).

Fig. 7a-c: *Bahusutrabeeja dwaya*

7a- Leaf spots

7b- Conidiophore and conidium

7c- Conidium

Fig. 8a-c: *Bahusutrabeeja manoharacharii*

8a- Leaf spots

8b- Conidiophores with conidia

8c- Conidia

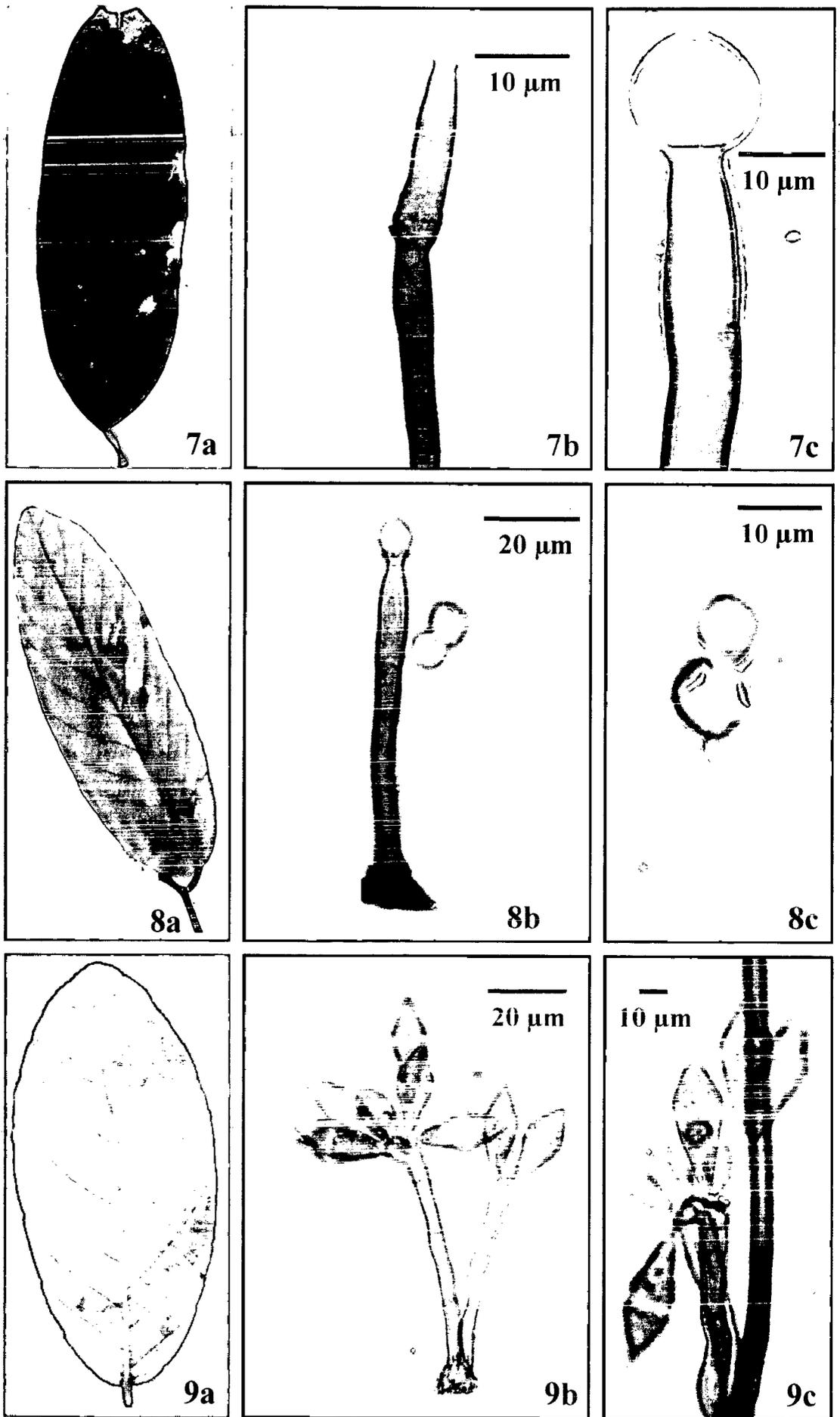
Fig. 9a-c: *Beltrania rhombica*

9a- Leaf spots

9b- Conidiophore with conidia

9c- Conidiophore, setae and conidia

Fig. 7 - 9



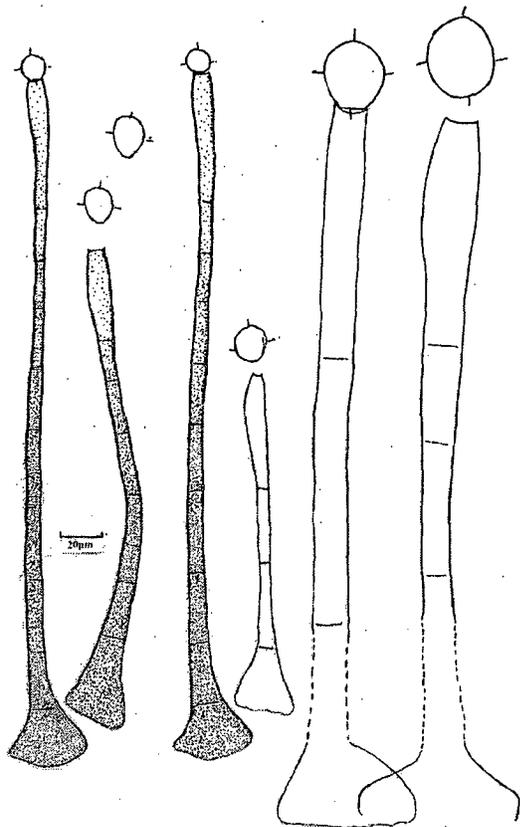


Fig. 7d *Bahusutrabeeja dwaya*

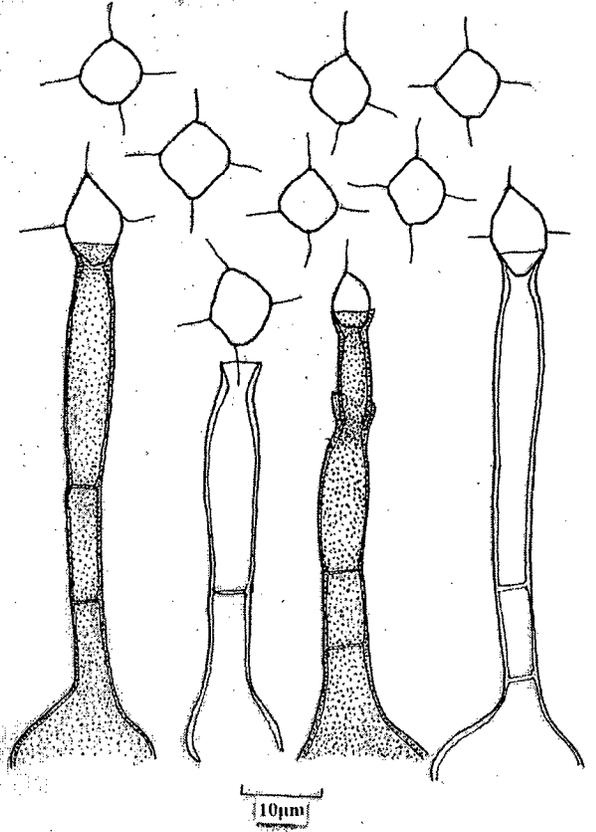


Fig. 8d *Bahusutrabeeja manoharacharii*

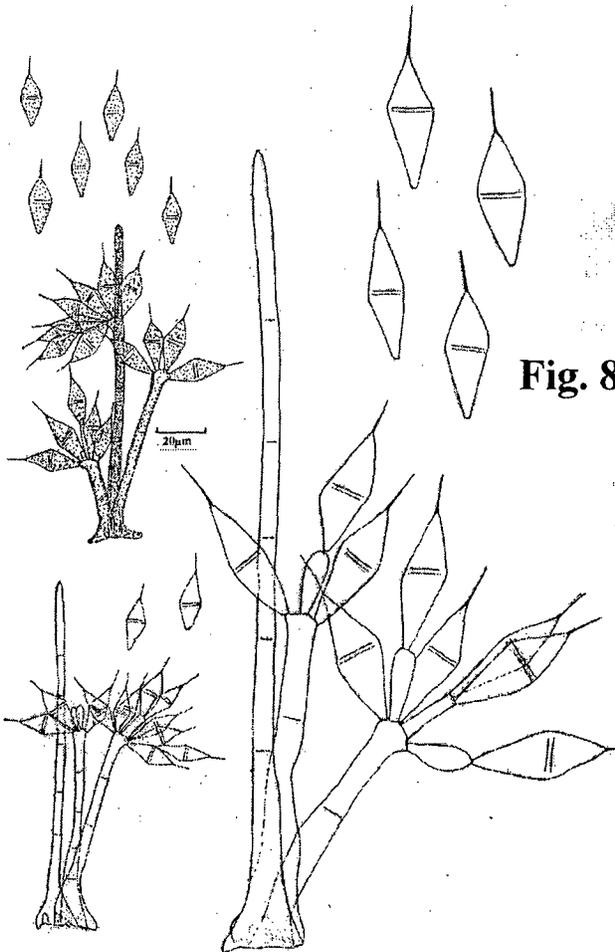


Fig. 9d *Beltrania rhombica*

9. *Beltrania rhombica* Penz., 1882. *Michelia*, 2 (8): 474.

(Fig.9a-c; 9d)

Fungus Hyphomycete. *Leaf spots* amphigenous, brown, irregular, 2-4 mm wide, only one to two spots were observed on each leaf. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, branched, septate, hyaline, 2-3 μm wide hyphae; *Stroma* none. *Setae* erect, straight to slightly flexuous, unbranched, septate, thick-walled, dark brown, 130-170 x 3-4.5 μm . *Hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, sometimes in group of 2-4, erect, straight to flexuous, unbranched, septate, smooth, pale brown, 40-110 x 3-6 μm . *Conidiogenous cells* polyblastic, terminal, integrated, determinate, denticulate, 8-10 x 3-5 μm ; denticles cylindrical, smooth, pale brown. *Conidia* solitary, simple, smooth, acropleurogenous, olivaceous brown, rhomboidal, biconic, appendiculate, aseptate, with a hyaline transverse band approximately in the middle, 20-28 x 7-10 μm ; appendage hyaline, smooth, 6-8 μm long.

Specimen examined: On living leaves of *Bridelia* sp. (Euphorbiaceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P91.

Almost all species of *Beltrania* Penzig & Sacc. are known as litter-inhabiting fungi (Ellis, 1971; 1976) and *B. rhombica* has been reported from India many times (Sarbhoy et al., 1996). Here the fungus is recorded for the first time as foliicolous.

10. *Beltraniella portoricensis* (Stevens) Piroz. & Patil, 1970. *Can. J. Bot.* 48(3): 575

(Fig.10a-c; 10d)

Fungus Hyphomycete. *Leaf spots* amphigenous, brown, irregular, 2-4 mm wide, only one to two spots were observed on few leaves of the plant. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* unbranched, erect, straight, thick-walled, smooth, dark brown, 85-200 x 3-4 μm . *Hyphopodia* absent. *Conidiophores* macronematous, mononematous, erect, straight to flexuous,

smooth, unbranched, septate, pale brown, arising at the base of setae, 37-75 x 2.5-4 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate, denticulate, 8-10 x 3-4.5 μm . *Conidia* solitary, simple, acropleurogenous, smooth, light olivaceous, obclavate, rounded at the apex, pointed at the base, aseptate, 20-26 x 5-7 μm .

Specimen examined: On living leaves of *Bridelia* sp. (Euphorbiaceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P87; Culture No. GUFCC No. 4905.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 5.6 cm in 7 days, irregular, leathery, off-white, margin wavy, reverse off-white.

Species of *Beltraniella* Subramanian are well known leaf-inhabiting litter fungi (Ellis, 1971; 1976) and *B. portoricensis* has been reported from India many times (Jamaluddin et al., 2004). Here the fungus is recorded for the first time as foliicolous.

11. *Ceeveesubramaniomyces litseai* Pratibha, Hyde and Bhat, 2004. *Kavaka*. 32: 21-26. (Fig.11a-c; 11d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, grayish, 4-6 mm in diam., later spreading on entire leaf surface. *Colonies* on leaf spots effuse, grayish brown, with mycelium internally in the substrate tissue, composed of septate, branched, hyaline to subhyaline, smooth, 2-4.5 μm wide hyphae. *Conidiophores* macronematous, mononematous, erect, straight to flexuous, septate, branched 1-2 times, light brown at the base, subhyaline to hyaline towards the tip, smooth, 100-170 μm long, 3.5-5 μm wide at the broadest region, septate, with a sharply curved, hook-like, thick-walled, dark brown, branch at midway from the base. *Conidiogenous cells* monophialidic, discrete, sometimes solitary above, mostly in verticils of 4-6 below

the hook-like curved branch; below the shield-like branch, ampulliform, smooth, very pale brown, curved inside, $6-8.5 \times 2-3.5 \mu\text{m}$; above the hook-like branch hyaline, smooth, lageniform, $6-17.5 \times 2.5-5 \mu\text{m}$, with or without a collarette. *Conidia* endogenous, hyaline, allantoid, smooth, rounded at ends, aseptate, $5-7.5 \times 2-3 \mu\text{m}$, produced in a slimy mass at the tip of the phialide.

Specimen examined: On living leaves of *Litsea* sp. (Lauraceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P198.

Genera such as *Cryptophiale* Pirozynski, *Kionochaeta* Kirk & Sutton and *Zanclospora* Hughes & Kendrick producing phialoconidia on mononematous, erect, setiform to mycelial, dark to medium brown, conidiophores with ampulliform to lageniform conidiogenous cells show some similarity with *Ceeveesubramaniomyces* (Ellis, 1971; Carmichael et al. 1980; Hawksworth et al. 1995). In *Cryptophiale*, typified by *C. kakombensis* Pirozynski, the row of phialides on the fertile zone of setiform conidiophore is covered by a palisade of sterile, shield-like tissue (Pirozynski 1968; Bhat & Kendrick 1993). In *Kionochaeta*, typified by *K. ramifera* (Matsushima) Kirk & Sutton (Kirk & Sutton, 1985), the setiform, branched, conidiophores are fertile mostly in the central part with penicillately arranged bunches of phialides. In *Zanclospora*, typified by *Z. novae-zelandiae* Hughes & Kendrick, the conidiophores bear verticils of sessile phialides in the central 3-4 septa (Hughes & Kendrick, 1965). In none of these, however, the hook-like, curved, dark-coloured, stiff branch developing from the septa above the whorl of conidiogenous cells is present, as in *Ceeveesubramaniomyces*.

12. *Ceratosporella deviata* Subram., 1957. *Proc. Indian Acad. Sci., Pl. Sci.* 46: 327.
(Fig.12a-c; 12d)

Fungus Hyphomycete. Leaf spots amphigenous, circular to irregular, dark brown to black in the centre with light brown margin, 5-8 mm wide. Colonies on leaf

Fig. 10a-c: *Beltraniella portoricensis*

10a- Leaf spots

10b- Conidiophores with seta and conidia

10c- Conidium

Fig. 11a-c: *Ceeveesubramaniomyces litseai*

11a- Leaf spots

11b- Conidiomata

11c- Conidia

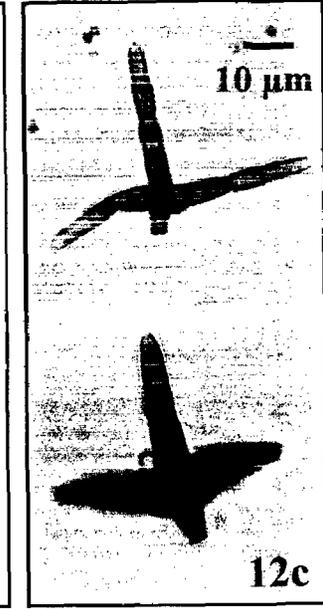
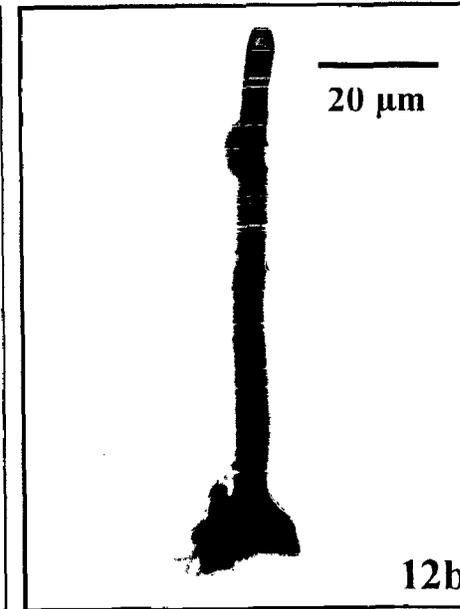
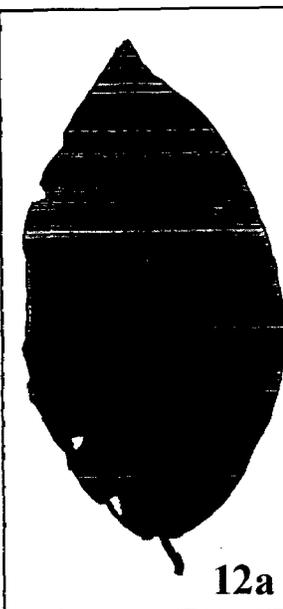
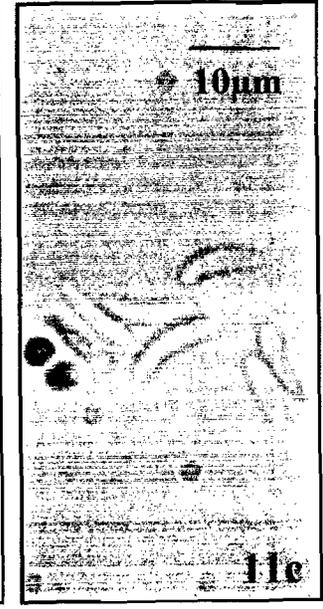
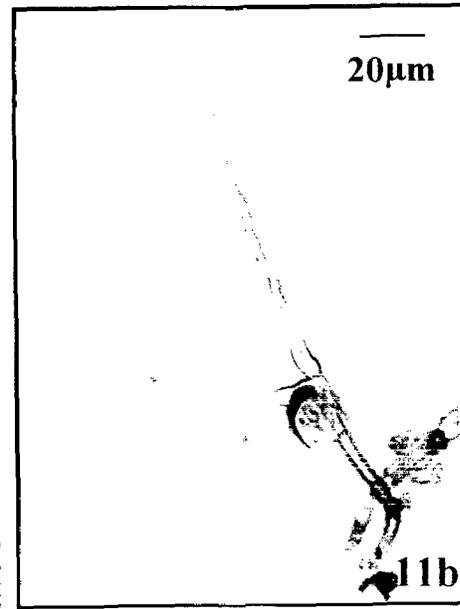
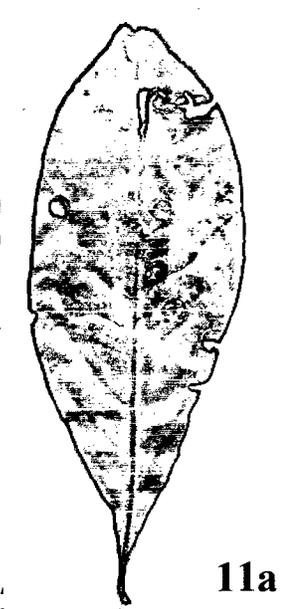
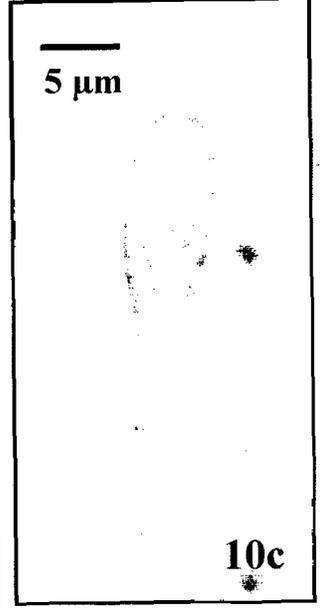
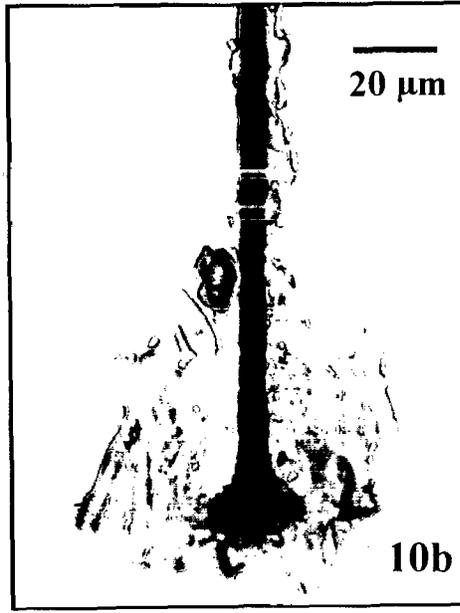
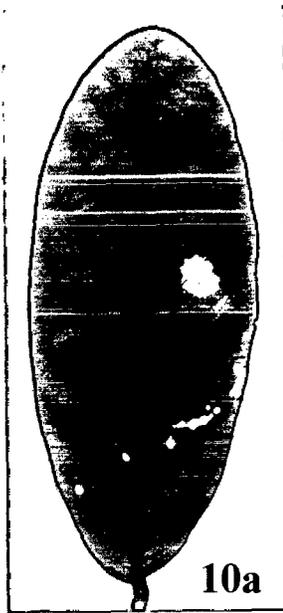
Fig. 12a-c: *Ceratosporella deviata*

12a- Leaf spots

12b- Conidiomata

12c- Conidia

Fig. 10 -12



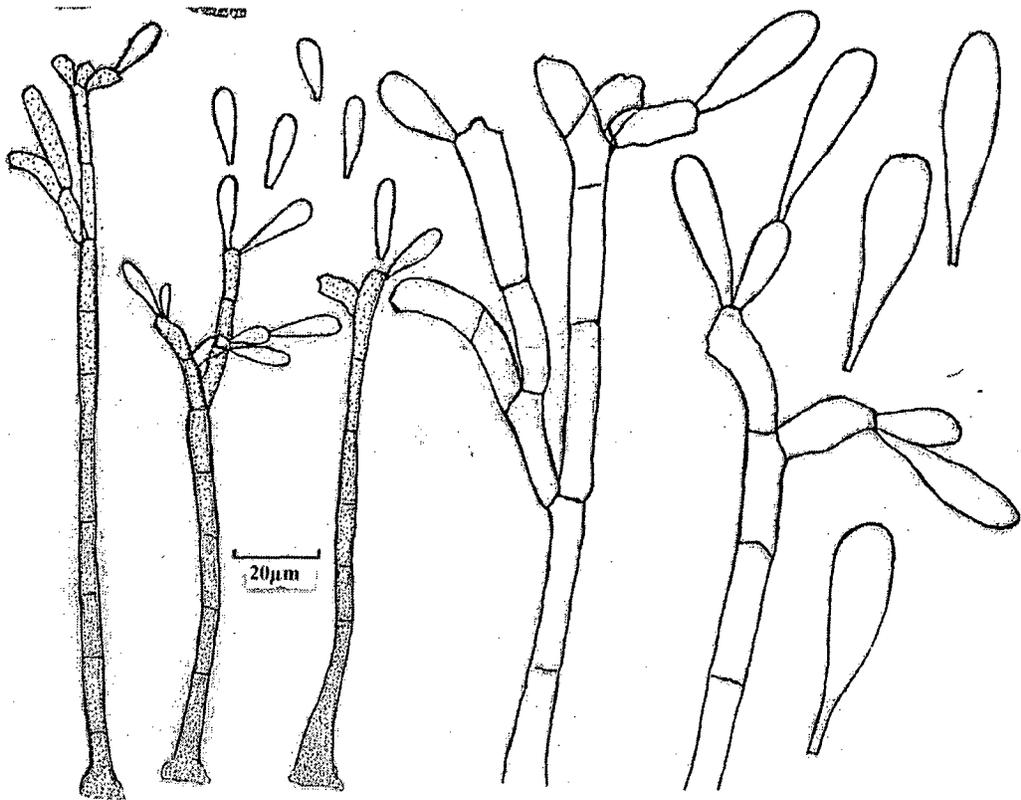


Fig. 10d *Beltraniella portoricensis*

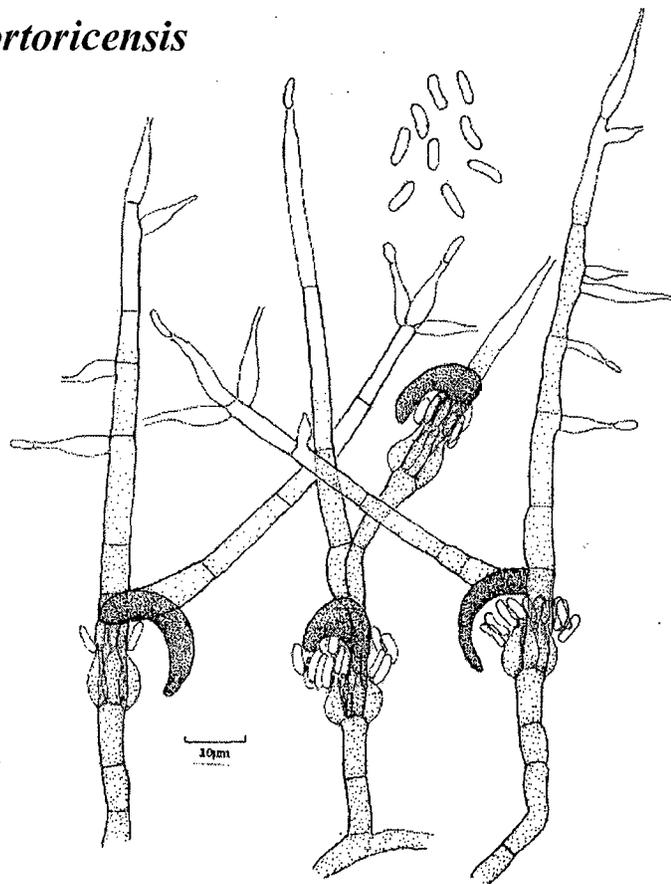


Fig. 11d *Ceevesubramaniomyces litseai*

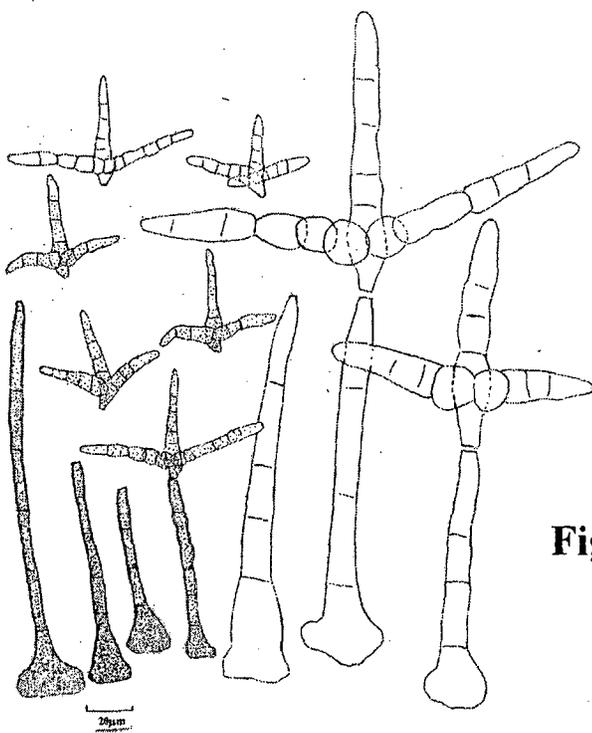


Fig. 12d *Ceratosporella deviata*

spots effuse, dark brown to black, hairy. Mycelium immersed. Stroma none. Setae and hyphopodia absent. Conidiophores macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, unbranched, dark brown, septate, thick-walled, 60-180 x 3-5 μm . Conidiogenous cells monoblastic, terminal, integrated, determinate, smooth, 13-21 x 3-4.5 μm . Conidia solitary, acrogenous, 3-4 armed, brown, 24-50 μm long, with turbinate, 8- 12 μm thick basal cell; arms septate, light brown, subulate, 30-60 μm long and 5-9 μm wide at the base.

Specimen examined: On living leaves of *Lagestroemia* sp. (Lythraceae), Amboli, Sawantawadi, Maharashtra, India, 17/07/04, Pratibha, J., Herb. No. GUBH P153.

The so far described 3 species of *Ceratosporella* Hohnel are well known litter fungi recorded mostly on fallen twigs (Ellis, 1971; 1976). *C. deviata* is, however, recorded for the first time here as foliicolous.

13. *Cercospora amorphophalli* Henn., 1902. *Hedwigia* 41: 147 (Fig.13a-c; 13d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown to black in the center with light brown margin, 3-5 mm in diam, later the center of the margin collapses, leading to the shot holes; infection observed on entire leaf surface and on most of the leaves. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* poorly developed, light brown. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, pale olivaceous, 40.5-215 x 4-7 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, sympodial, cicatrized, conidial scars unthickened, somewhat darkened. *Conidia* solitary, simple, dry, acropleurogenous, hyaline, pluriseptate, scolecosporous, acicular, smooth, straight to slightly flexuous, 20-70 x 3-5 μm , with unthickened, somewhat darkened hilum.

Specimen examined: On living leaves of *Amorphophallous campanulatus* Decne. (Araceae), St. Estevam, Tiswadi, Goa, 19-07-03, Herb. No. GUBH P55; Banastrai, Ponda Goa, 02/11/04, Pratibha, J., Herb. No. GUBH P55.

Till date 3 species of *Cercospora*, viz. *C. amorphophalli*, *C. cheveileri* Sacc. and *C. protensa* Syd. are reported on the host genus *Amorphophallous*. Our isolate showed similarity with *C. amorphophalli* with respect to the shape and size of conidiophores and conidia. The fungus was isolated from the same host from two different places.

14. *Cercospora apii* ~~Fries~~, 1863. *Mykol.* 3: 91

(Fig.14a-c; 14d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, pale brown with white spot in the centre, margin dark brown, 2-4 mm in diam, observed on the entire leaf surface. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, arising from stomata, becoming erumpent, loose in the upper part, erect, straight to slightly flexuous, unbranched, septate, smooth, pale brown, wall somewhat thickened, 17.5-60 x 3-5.5 μ m. *Conidiogenous cells* polyblastic, terminal later becoming intercalary, sympodial, determinate, integrated, cicatrized, conidial scars thickened and darkened. *Conidia* solitary, hyaline, pluriseptate, obclavate, sub-cylindrical, smooth, 5-8 septate, sub-hyaline to very pale olivaceous, apex sub-obtuse, base somewhat rounded 57-92 μ m long, 3.5-5.5 μ m wide at the broadest region, 1.5-2.5 μ m at the tip, with thickened and darkened hilum.

Specimen examined: On living leaves of *Impatiens* sp., (Balsaminaceae), Bondla, Ponda Goa, 24/05/03, Herb. No. GUBH P32; Banastari, Ponda Goa, 17/04/04, Herb. No. GUBH P32; Campal, Panjim Goa, 27/08/04, Pratibha, J., Herb. No. GUBH P32.

So far 8 species of the genus *Cercospora*, viz. *C. apii*, *C. balsaminae* Syd., *C. balsaminiana* Yen & Lim, *C. balsaminicola* Yen & Lim, *C. campi-silii* Speg., *C. fukushiana* (Matsuura) Yamam, *C. impatientis* Bäumler and *C. nojimai* Togashi &

Katsuki, were reported on *Impatiens* (Index Fungurum). *Cercospora apii* was isolated from 3 different places on the same host and this further indicates the intimate host specificity of the fungus.

15. *Cercospora arisaemae* Tai, 1936. Bull. Chin. Bot. Soc. 2: 47 (Fig.15a-c; 15d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, brown in the centre with grayish margin, 2-3 mm in diameter, central portion later collapses leaving the shot hole, only one to three spots were seen on each leaf. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in dense fascicles, erect, straight to flexuous, smooth, unbranched, 2-5 septate, olivaceous brown, thick-walled, 50-130 x 4.5-7.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, cicatrized, sympodial, with thickened, not darkened conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 65-130 x 2.5-4.5 μm , with thickened, not darkened hilum.

Specimen examined: On living leaves of *Arisaema* sp. (Araceae), Amboli, Sawantwadi, Maharashtra India, 17/07/04, Pratibha, J., Herb. No. GUBH P156; Culture No. GUFCC No. 4906.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.8 cm in 7 days, circular, leathery, dark green, margin smooth, reverse black.

Only 2 species of *Cercospora*, i.e. *C. arisaemae* and *C. guttulata* Ellis & Kellerm, are so far known on the host genus *Arisaema* and the isolated species showed similarity with the reported *C. arisaemae* with respect to the shape and size of conidiophores and conidia.

Fig. 13a-c: *Cercospora amorphophalli*

13a- Leaf spots

13b- Conidiomata

13c- Conidium

Fig. 14a-c: *Cercospora apii*

14a- Leaf spots

14b- Conidiomata

14c- Conidium

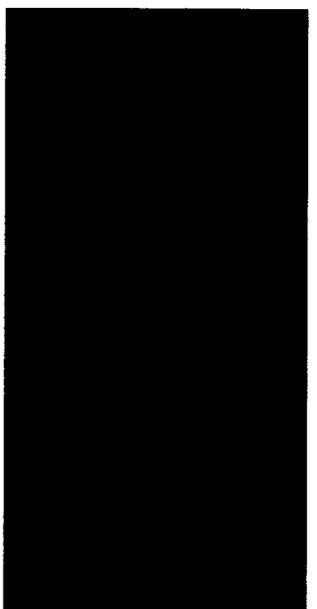
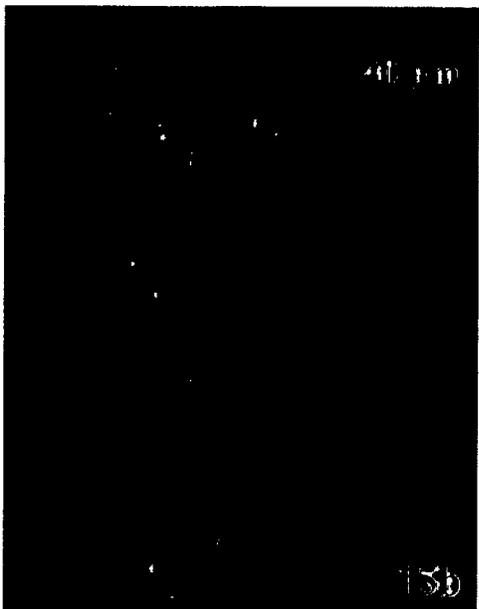
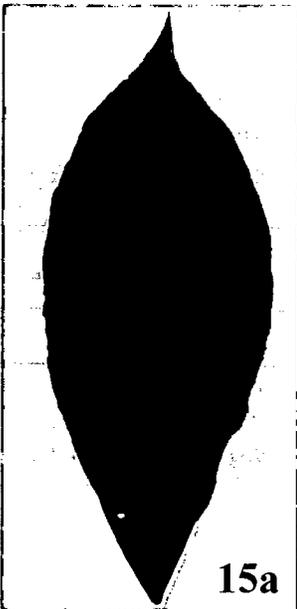
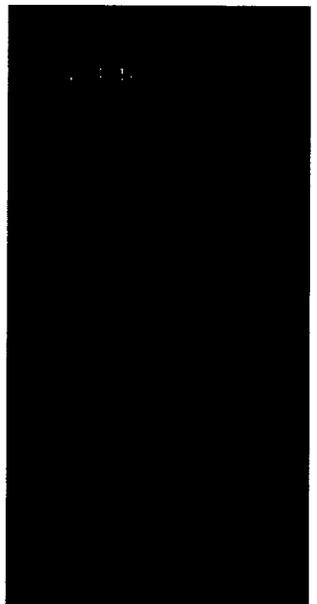
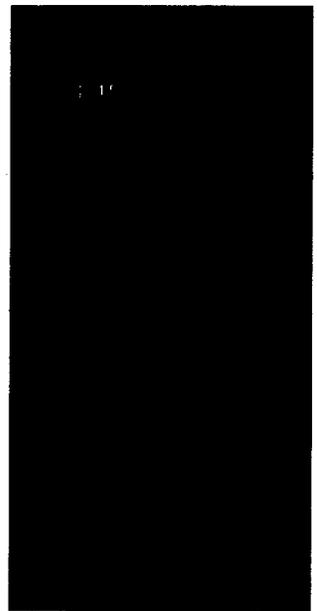
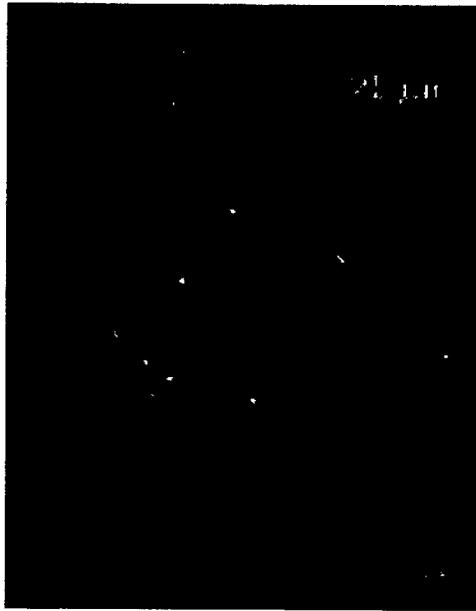
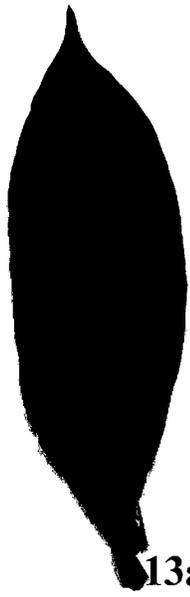
Fig. 15a-c: *Cercospora arisaemae*

15a- Leaf spots

15b- Conidiomata

15c- Conidium

Fig. 13-15



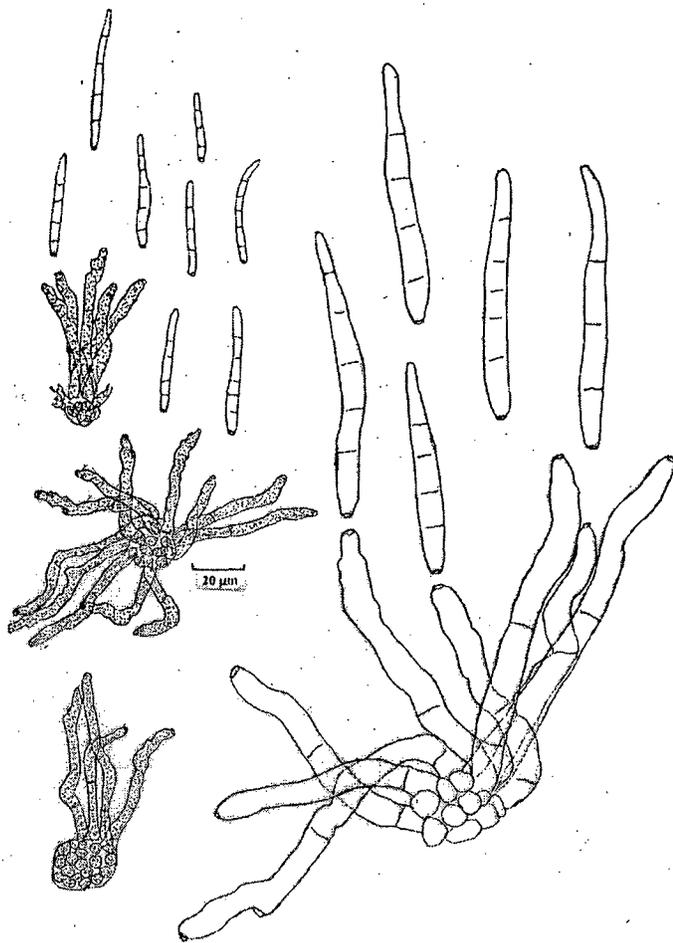


Fig. 13d *Cercospora amorphophalli*

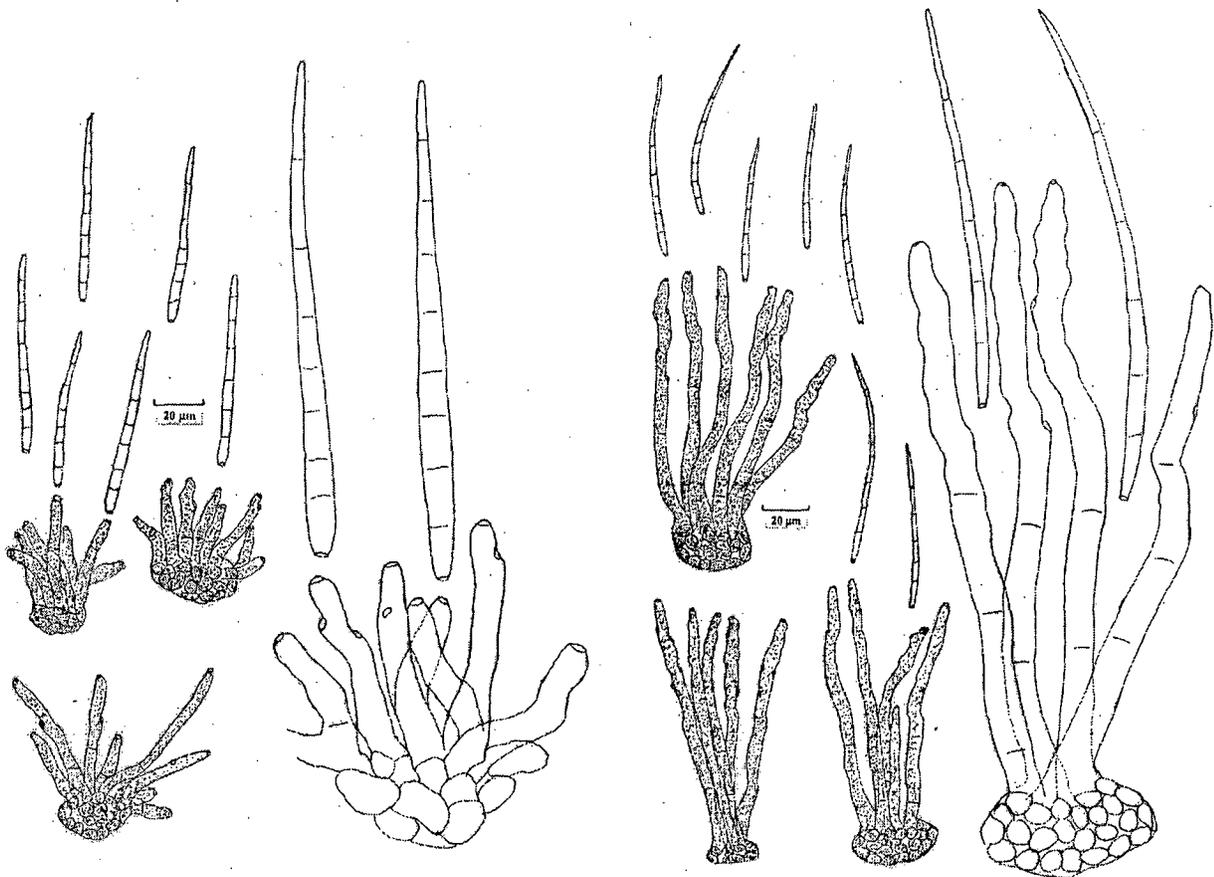


Fig. 14d *Cercospora apii*

Fig. 15d *Cercospora arisaemae*

16. *Cercospora caladii* Cooke, 1880. *Grevillea*, 8(47): 95

(Fig.16a-c; 16d)

Fungus Hyphomycete. *Leaf spots* amphigenous, numerous, circular, light brown with dark brown margin, 1-2 mm in diam., observed on entire leaf surface. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, brown, 70-150 x 3-4.5 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, with rim like thickened and darkened conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, hyaline, pluriseptate, scolecosporous, apex sub-acute, base flattened, smooth, straight to slightly flexuous, 70-80 x 2-3.5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Colocasia antiquorum* (Linn.) Schott (Areceae), Valpoi, Sattari Goa, 05/07/03, Herb. No. GUBH P40; Banastari, Ponda Goa, 21/09/04, Pratibha, J., Herb. No. GUBH P40.

Two species of *Cercospora*, namely *C. caladii* and *C. colocasiae* (Höhn.) Chupp are known on the host genus *Colocasia* and the isolated species, *C. caladii*, was recovered from the same host at two different places.

17. *Cercospora canescence* Ellis & Martin, 1882. *Nat.* 16: 1003

(Fig.17a-c; 17d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, light brown with grey spot in the centre, tiny about 2-3 mm in diameter, spreading on entire leaf surface, most of the leaves in the field showed infection. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* dark brown. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large fascicles, erect, straight to slightly flexuous, unbranched, septate,

smooth, brown, 55-220 x 3-5.5 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, sympodial, with thickened and darkened conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, hyaline to pale olivaceous, pluriseptate, scolecosporous, acicular, smooth, straight, 30-355 x 3-4.5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Vigna catjang* (Burm.) Walp. (Fabaceae) Caranzalem, Tiswadi Goa, 08/06/03, Herb. No. GUBH P37; Banastari, Ponda Goa, 08/11/04, Pratibha, J., Herb. No. GUBH P37.

Till date 14 species of *Cercospora*, viz. *C. canescens*, *C. cruenta* Sacc., *C. dolichi* Ellis & Everh, *C. kikuchii* (Tak. Matsumota & Tomoy.) M.W. Gardner, *C. longispora* Peck. (= *C. longissima*), *C. neovignae* Yamam. (= *Pseudocercospora cruenta*), *C. raciborskii* Sacc. & Syd. (= *C. nicotianae*), *C. shihmenensis* Yen (= *Pseudocercospora shihmenensis*), *C. vanderystii* Henn., *C. vexillatae* Yen, *C. vignae* Ellis & Everh. (= *Pseudocercospora cruenta*), *C. vignae-vexillatae* Baker & Dale, *C. vignicaulis* Tehon and *C. vignicola* Kawam. (= *Corynespora casiicola*) are reported on the host genus *Vigna*. Our isolate showed similarity with *C. canescence* with respect to the shape and size of conidiophores and conidia. The fungus was isolated from the same host from two different places.

18. *Cercospora canscorina* Chidd., 1959. *Sydowia* 13: 155 (Fig.18a-c; 18d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, light brown, 3-5 mm in diam. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* brown, 20-25 μm . *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, unbranched, septate, dark brown at the base, olivaceous brown at the tip, thick-walled, 35-90 x 3-7 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, cicatrized, sympodial, with rim like, thickened

Fig. 16a-c: *Cercospora caladii*

16a- Leaf spots

16b- Conidiomata

16c- Conidia

Fig. 17a-c: *Cercospora canescence*

17a- Leaf spots

17b- Conidiomata

17c- Conidia

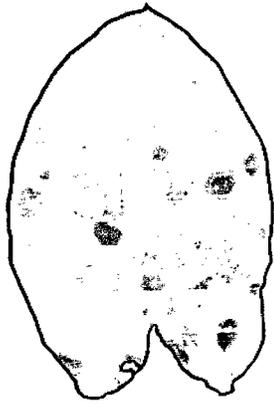
Fig. 18a-c: *Cercospora canscorina*

18a- Leaf spots

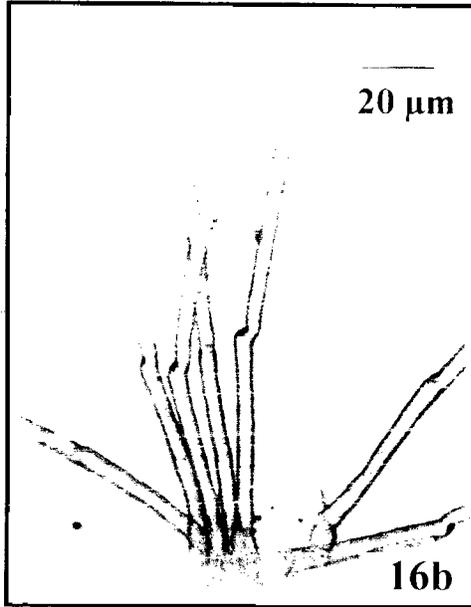
18b- Conidiomata

18c- Conidium

Fig. 16-18

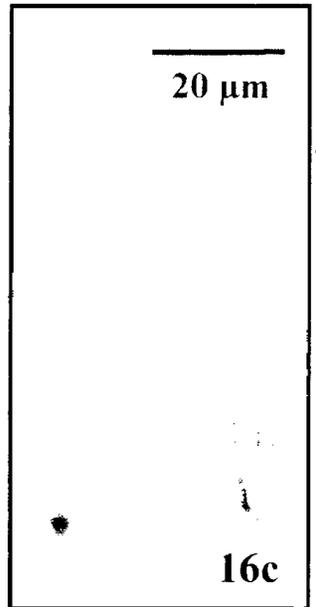


16a



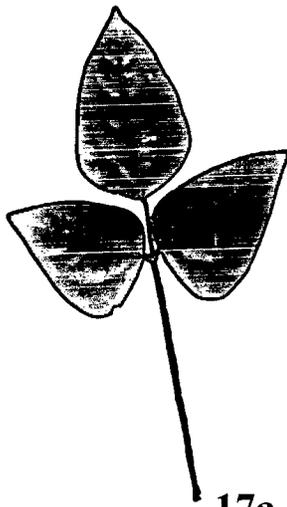
20 μm

16b

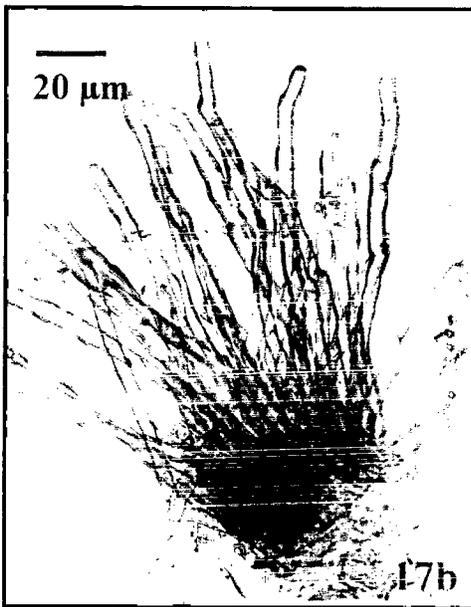


20 μm

16c

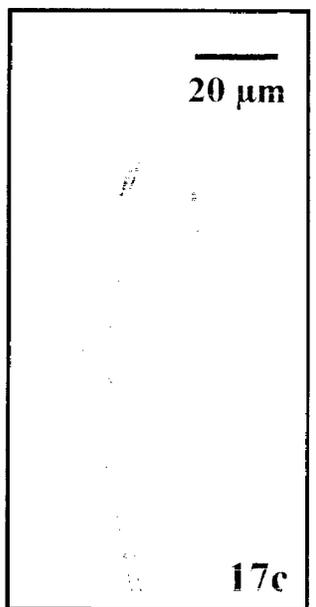


17a



20 μm

17b

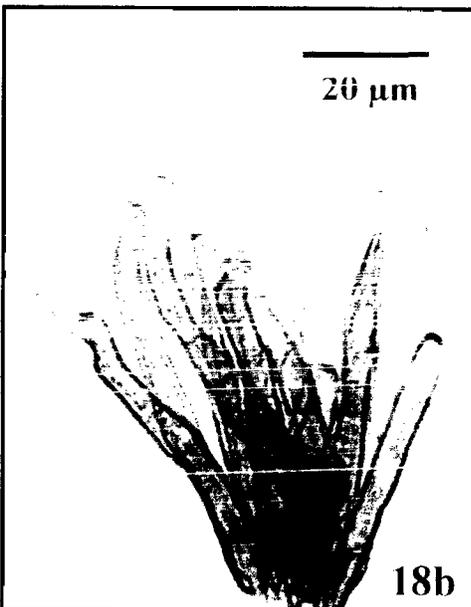


20 μm

17c

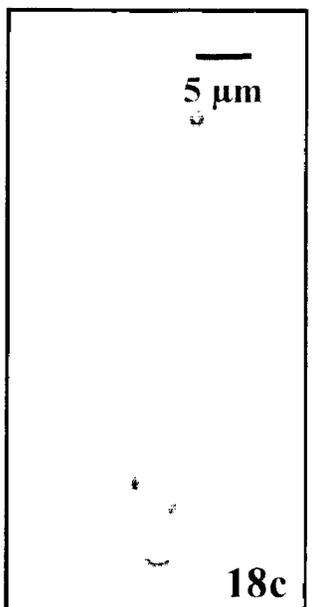


18a



20 μm

18b



5 μm

18c

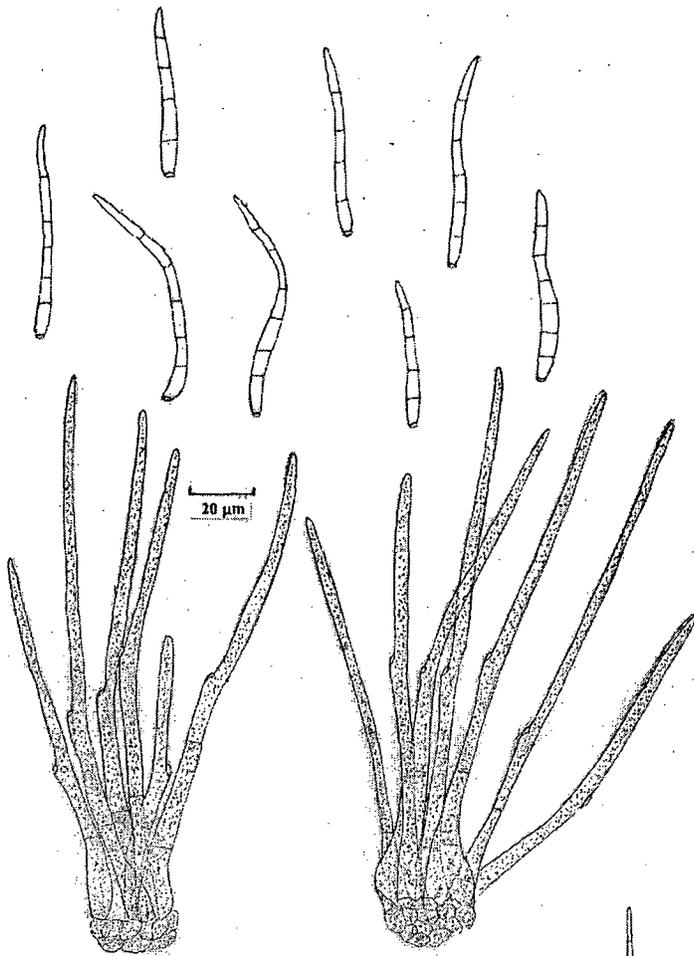


Fig. 16d *Cercospora caladii*

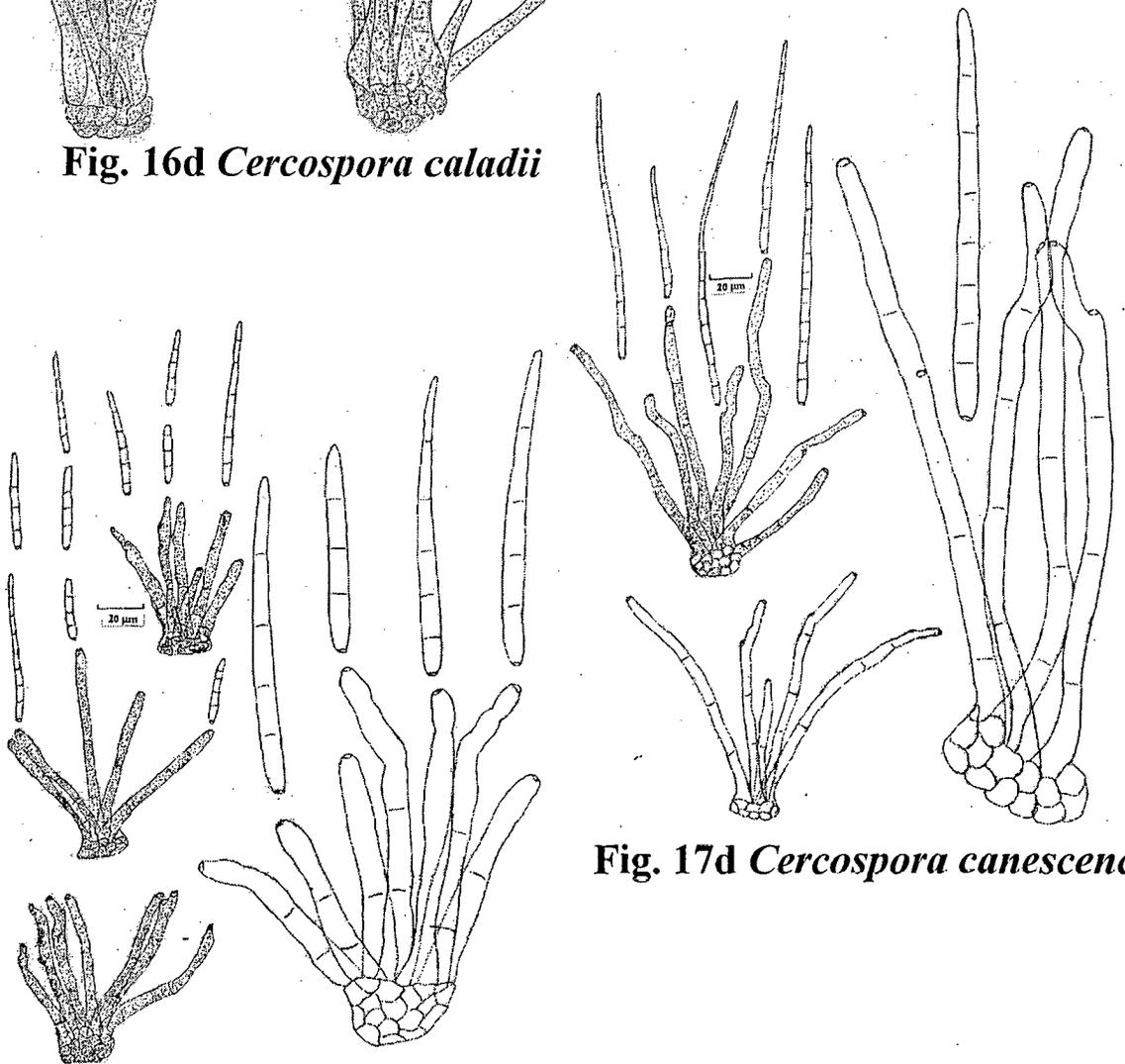


Fig. 17d *Cercospora canescence*

Fig. 18d *Cercospora canscorina*

and darkened conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 50-70 x 2.5-5.5 μm with thickened and darkened, rim-like hilum.

Specimen examined: On living leaves of *Canscora diffusa* (Vahl) Roem. and Schult. (Gentianaceae), Amboli, Sawantwadi, Maharashtra India. 29/11/03, Pratibha, J., Herb. No. GUBH P117.

This is the only species of *Cercospora* so far known on the host genus *Canscora*.

19. *Cercospora capsicigena* Bhartiya, Dubey & Singh, 2000. *Indian Phytopath.* 53(2): 149-152 (Fig.19a-c; 19d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, to irregular, initially tiny, later coalescing to form large patches, grayish white in the centre with dark brown to black margin, upto 10 mm wide, spreading on entire leaf surface, many leaves in the field showed the infection. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* well developed, spherical, compact, brown, 25-35 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, unbranched, 1-3 transversely septate, olivaceous brown at the base, paler towards the tip, thick-walled, 15-85 x 3.5-7 μm . *Conidiogenous cells* mostly monoblastic, sometimes polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial; cicatrized, with conspicuous, thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, truncate at the base, acute to sub-acute at the apex, 30-120 x 2-4 μm , with thickened and darkened, rim-like hilum.

Specimen examined: On living leaves of *Capsicum annum* Linn. (Solanaceae), Banastari, Ponda Goa, 07/04/04, Pratibha, J., Herb. No. GUBH P125.

Five species of *Cercospora*, namely *C. capsici* Held & Wolf, *C. capsicicola* Vassiljevsky, *C. capsicigena*, *C. melongena* Welles and *C. unamunoi* Castell. are so far known from the host genus *Capsicum*. The isolated species showed similarity with *C. capsicigena* with respect to shape and size of the conidiophores and conidia.

20. *Cercospora citrullina* Cooke, 1883. *Grevillea* 12(61): 31 (Fig.20a-c; 20d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, grey in the centre with light brown margin, tiny about, 1-2 mm in diameter, observed on almost entire leaf and most of the leaves in the field. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, light yellow, 35.5-80 x 3-7 μm . *Conidiogenous cells* polyblastic, terminal, integrated, determinate, sympodial, with thickened and darkened conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, hyaline to sub-hyaline, pluriseptate, scolecosporous, acicular, smooth, straight, 22.5-55.5 x 3.5-4.5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Coccinia grandis* (Linn.) Voigt. (Cucurbitaceae), Corjuvem, Bardez Goa, 31/05/03, Herb. No. GUBH P36; Caranzalem, Tiswadi Goa, 08/06/03, Pratibha, J., Herb. No. GUBH P36.

Till date 3 species of *Cercospora* namely *C. bangalorensis* Thirum. & Chupp, *C. citrullina* and *C. coccineae* Munjal, Lall & Chona are recorded on the host genus *Coccinea*. The isolated species is closely related to *C. citrullina* with respect to the size of the conidiophores and conidia.

21. *Cercospora coicis* M.S.Patil & Sawant, 1991. *Indian Phytopath.* 44 (1): 17

(Fig.21a-c; 21d)

Fungus Hyphomycete. *Leaf spots* amphigenous, spindle shaped, gray in the centre with dark brown to black margin, 2-3 mm wide. *Colonies* on leaf spots effuse,

Fig. 19a-c: *Cercospora capsicigena*

19a- Leaf spots

19b- Conidiomata

19c- Conidium

Fig. 20a-c: *Cercospora citrullina*

20a- Leaf spots

20b- Conidiophores with conidia

20c- Conidiophores with conidia

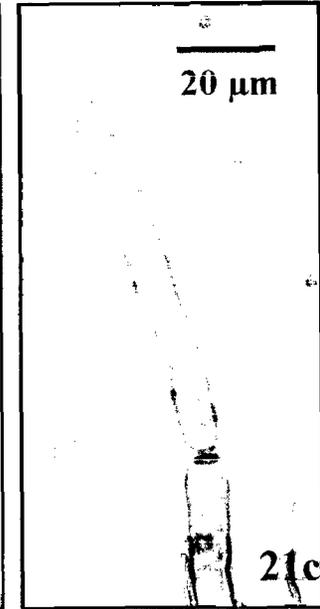
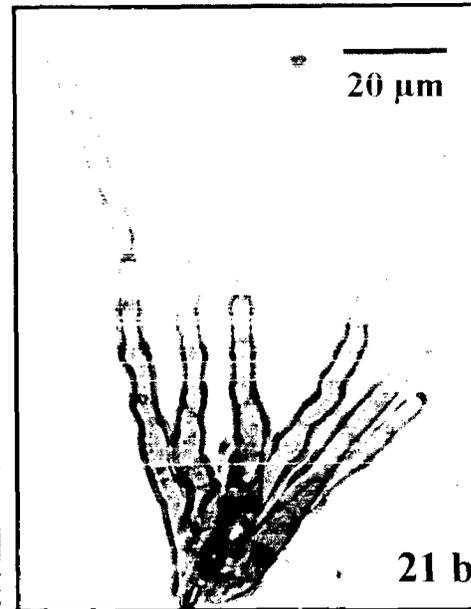
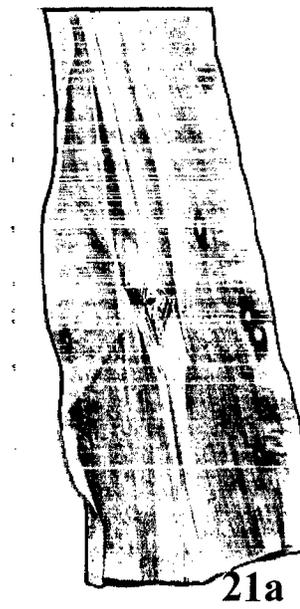
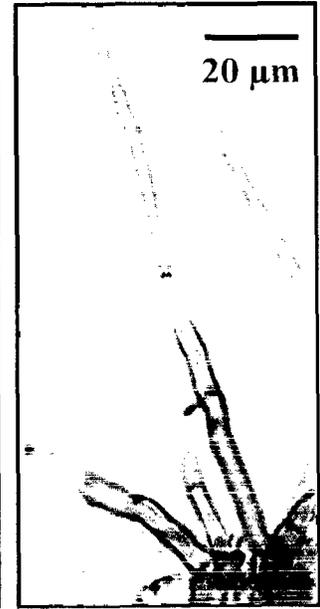
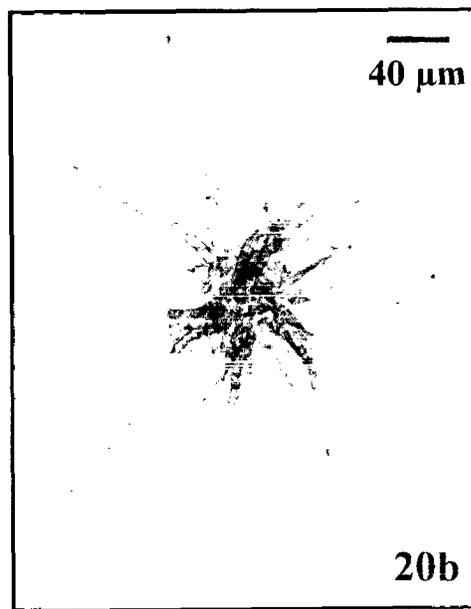
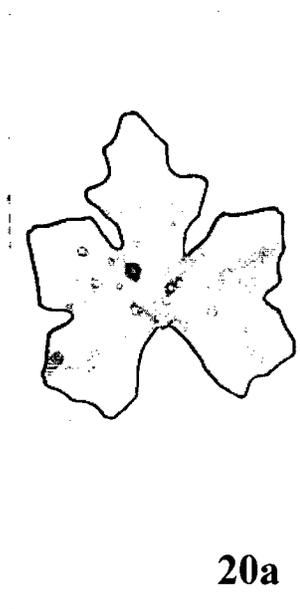
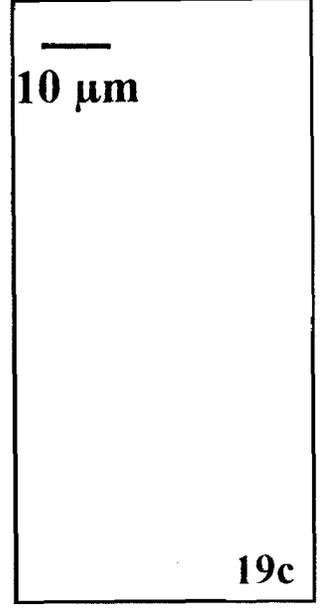
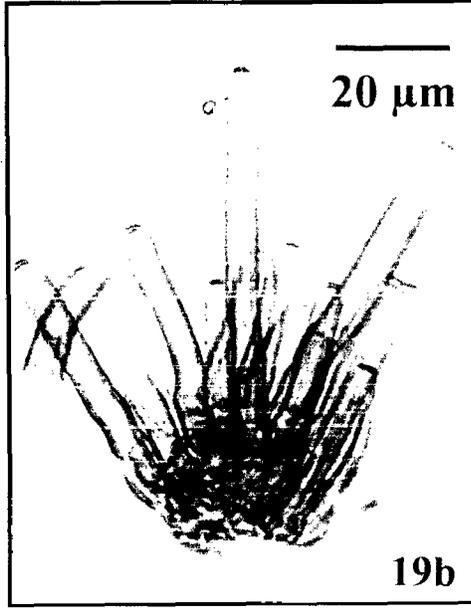
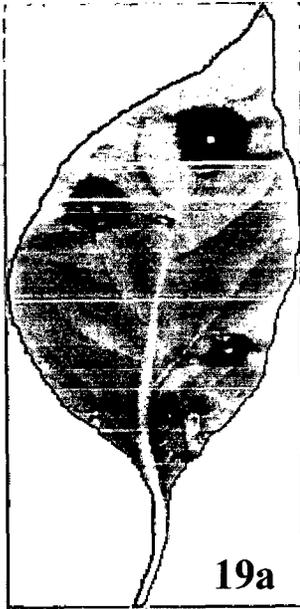
Fig. 21a-c: *Cercospora coicis*

21a- Leaf spots

21b- Conidiophores with conidia

21c- Conidium

Fig. 19-21



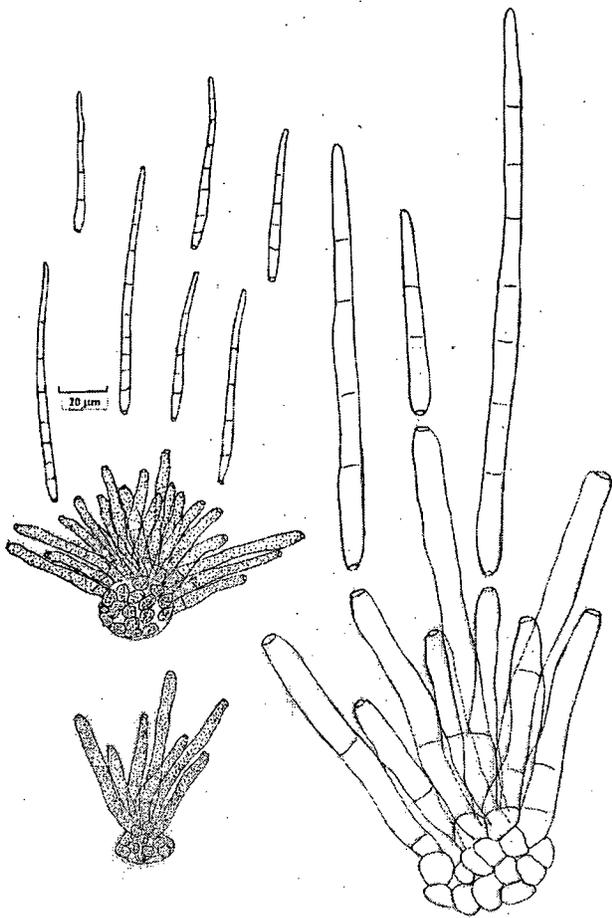


Fig. 19d *Cercospora capsicigena*

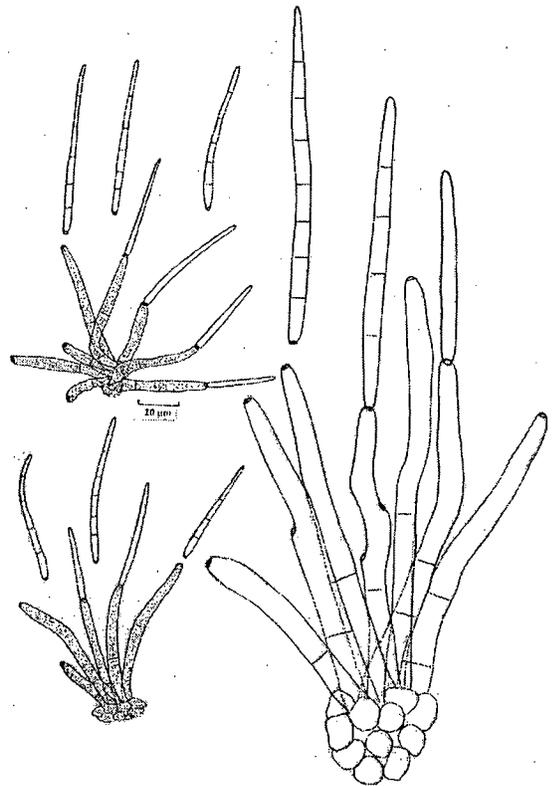


Fig. 20d *Cercospora citrullina*

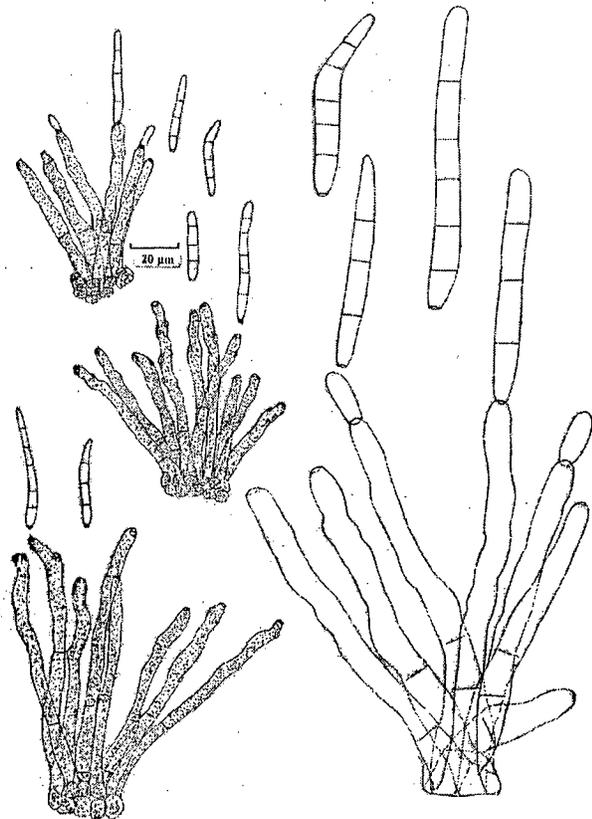


Fig. 21d *Cercospora coicis*

light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, septate, brown, thick-walled, 80-130 x 3.5-7.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, cicatrized, sympodial, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to slightly flexuous, pluriseptate, pointed at the tip, rounded at the base, 50-80 x 3-6.5 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Coix* sp. (Poaceae), Carambolim, Tiswadi Goa, 01/10/03, Harshala, G., Herb. No. GUBH P102.

So far 2 species of *Cercospora* namely *C. coicis* and *C. coleicola* Chupp & Mull. are recorded on the host genus *Coix*. The isolated species is closely related to *C. coicis* with respect to the shape and size of the conidiophores and conidia.

22. *Cercospora colocasiae* (Höhn.) Chupp, 1954. *Monograph of Cercospora*, 58p

(Fig.22a-c; 22d)

Fungus Hyphomycete. *Leaf spots* amphigenous, numerous, circular, light brown with dark brown margin, 1-2 mm in diam., observed on entire leaf surface. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in dense fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, dark brown, 130-195 x 3-6.5 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened conidial scars. *Conidia* solitary, simple, dry,

acropleurogenous, hyaline, pluriseptate, scolecosporous, acicular, smooth, straight, 70-87.5 x 3-5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Colocasia antiquorum* (Linn.) Schott (Areceae), St. Estevam, Tiswadi, Goa, 19-07-03, Herb. No. GUBH P54; Paryem, Sattari Goa, 02/07/04, Herb. No. GUBH P54; Valpoi, Sattari Goa, 10/08/04, Herb. No. GUBH P54; Bondla, Ponda Goa, 07/07/05, Pratibha, J., Herb. No. GUBH P54.

Two species of *Cercospora* viz. *C. caladii* and *C. colocasiae* are recorded so far from *Colocasia*. *Cercospora colocasiae* was isolated from 4 different localities on the same host, which indicates the specificity of the fungus to the host.

23. *Cercospora erythrinicola* Tharp, 1917. *Mycologia*, 9: 109 (Fig.23a-c; 23d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, dark brown to black, 6-8 mm wide, only one spot on each leaf was observed on few leaves of the tree. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, unbranched, septate, light brown, thick-walled, 60-180 x 3-6 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 55-190 x 3-6 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Erythrina indica* Lam. (Fabaceae), Donapaula, Tiswadi Goa, 13/11/03, Pratibha, J., Herb. No. GUBH P112.

Six species of *Cercospora*, viz. *C. erythrinae* Ellis & Everh., *C. erythrinae-lithospermae* Agnihothr., *C. erythrinicola*, *C. pittierii* Syd., *C. pulviniformis* Kranz and *C. tomentosae* Hansf. are so far known from *Erythrina* and the isolated species showed similarity with *C. erythrinicola* with respect to size of conidiophores and conidia.

Fig. 22a-c: *Cercospora colocasiae*

22a- Leaf spots

22b- Conidiomata

22c- Conidiophores

Fig. 23a-c: *Cercospora erythrinicola*

23a- Leaf spots

23b- Conidiomata

23c- Conidium

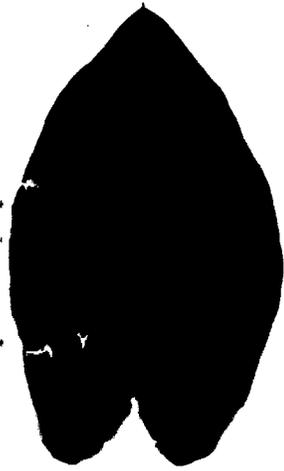
Fig. 24a-c: *Cercospora fukushiana*

24a- Leaf spots

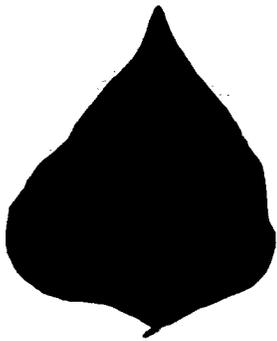
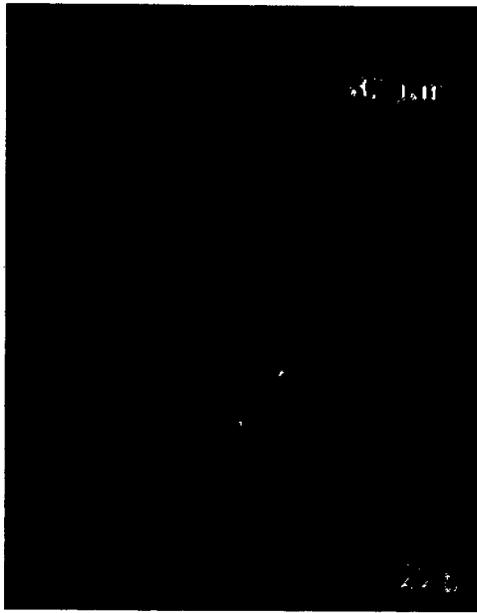
24b- Conidiomata

24c- Conidium

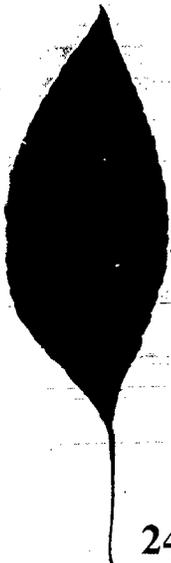
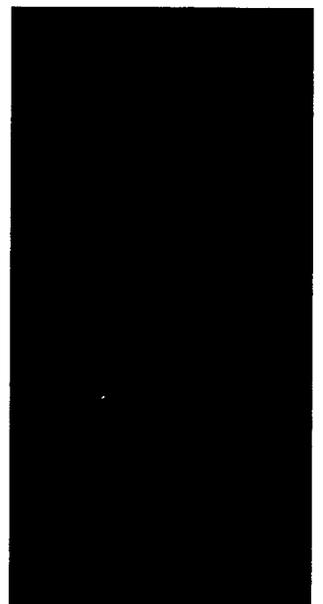
Fig. 22-24



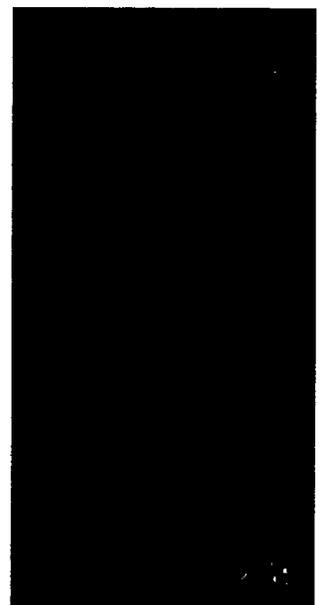
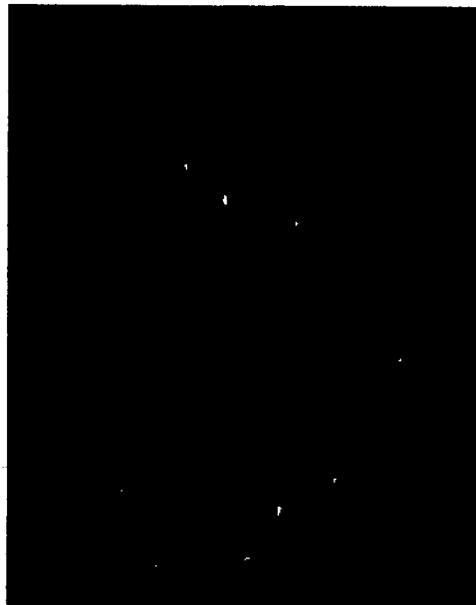
22a



23a



24a



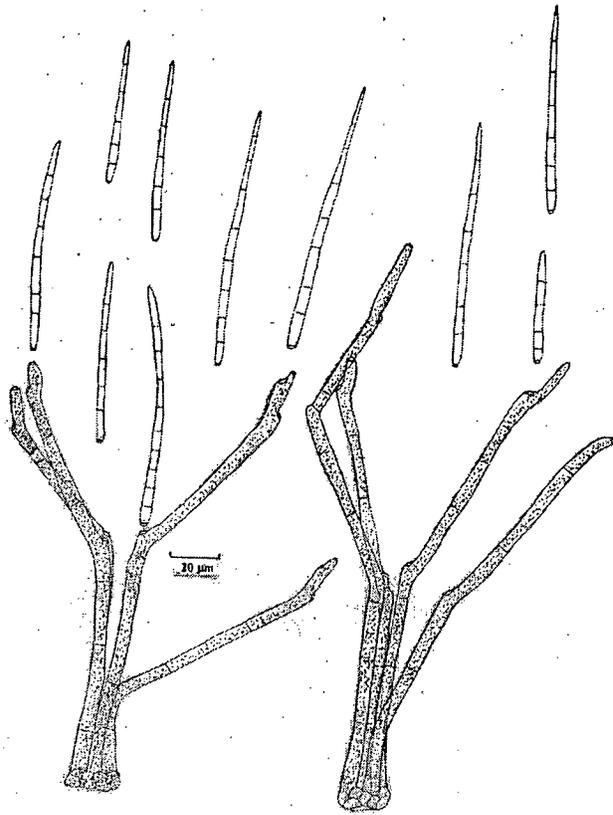


Fig. 22d *Cercospora colocasiae*

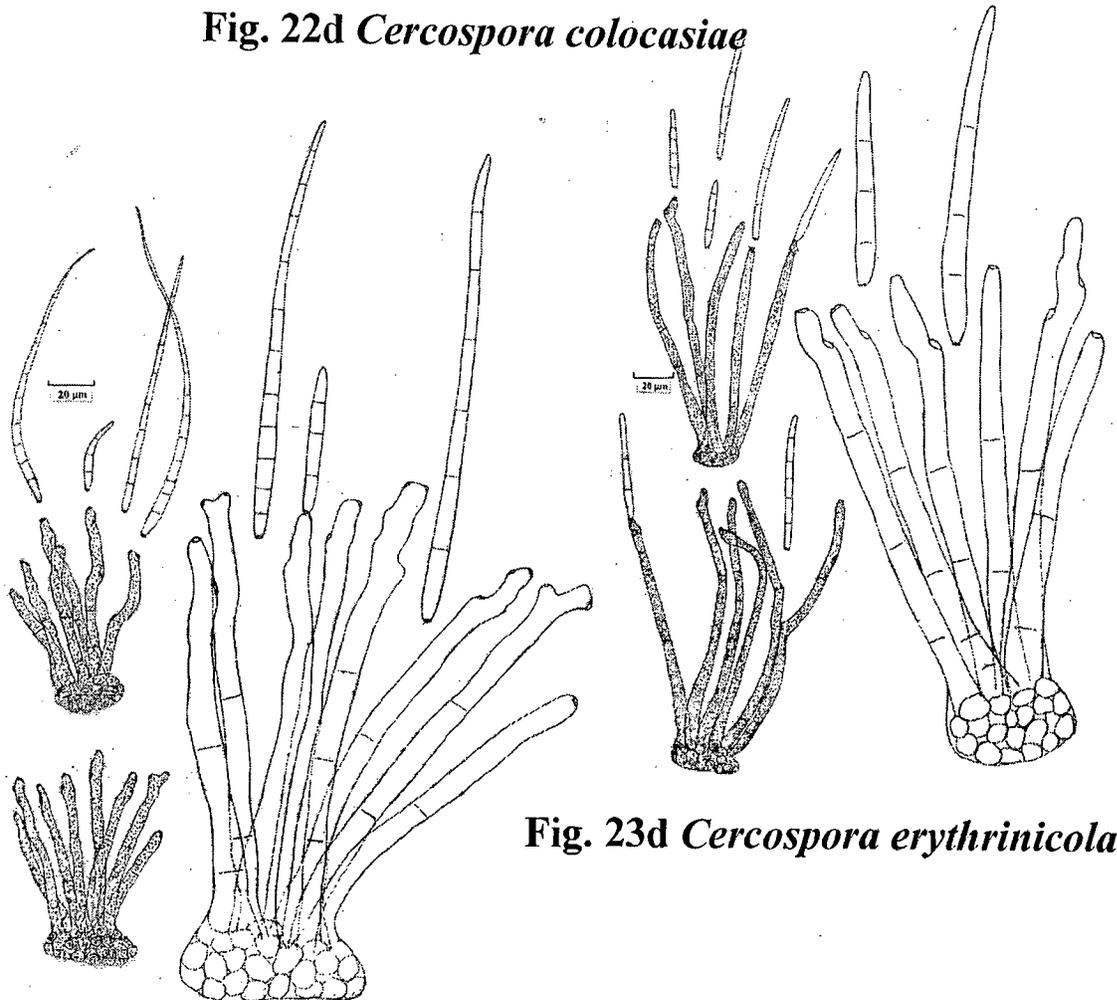


Fig. 23d *Cercospora erythrinicola*

Fig. 24d *Cercospora fukushiana*

24. *Cercospora fukushiana* (Matsuura) Yamamoto, 1943. *J. Soc. Trop. Agr.* 6: 601

(Fig.24a-c; 24d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, gray with dark brown margin, 2-5 mm in diameter, later the central portion collapses leaving the shot hole, spreading on entire leaf surface. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* partly immersed, partly superficial, composed of branched, septate, sub-hyaline, 2-2.5 μm wide hyphae. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, septate, brown, thick-walled, 40-130 x 3-6 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 30-165 μm long, 2-3.5 μm wide at broadest part, 1.5-2 μm at the pointed at tip, with thickened and darkened, rim-like hilum.

Specimen examined: On living leaves of *Impatiens pulcherrima* Dalz. (Balsaminaceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P82.

A total of 8 species of *Cercospora*, viz. *C. apii*, *C. balsaminae*, *C. balsaminiana*, *C. balsaminicola*, *C. campi-silii*, *C. fukushiana*, *C. impatientis* and *C. nojimai* are known to be reported from *Impatiens*. Size of the conidiophore and conidia were similar to that of *C. fukushiana*.

25. *Cercospora gerberae* Chupp & Viégas, 1945. In: Viegas, *Boln da Soc. Brasil de Agron.* 8: 27

(Fig.25a-c; 25d)

Fungus Hyphomycete. *Leaf spots* amphigenous circular, sometimes irregular, light brown in the centre with dark brown to black margin, 5-6 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium*

immersed. *Stroma* poorly developed, brown. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, septate, brown, thick-walled, 120-305 x 3.5-6 μm . *Conidiogenous cells* mostly monoblastic, rarely polyblastic, terminal, later becoming intercalary, integrated, determinate, cicatrized, sympodial, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 150-360 x 3-5 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Gerbera* sp. (Asteraceae), NIO Campus, Donapaula, Tiswadi Goa, 12/08/04, Ashish, P., Herb. No. GUBH P165; Banastari, Ponda Goa, 21/10/04, Pratibha, J., Herb. No. GUBH P165(a).

Two species of *Cercospora*, viz. *C. apii* and *C. gerberae* are reported on the host plant *Gerbera*. Isolated species was assigned to *C. gerberae* in view of its similarities in morphology and dimensions of conidiophores and conidia. The fungus was isolated from two different localities from same host.

26. *Cercospora hydrocotyles* Ellis & Everh., 1887. *J. Mycol.* 3: 16 (Fig.26a-c; 26d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, light brown, 2-3 mm in diam. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, 2-5 septate, brown, thick-walled, 70-170 x 4-7.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 55-80 x 3-5 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Centella asiatica* Linn. (Apiaceae), Mashem, Cancona Goa, 06/04/04, Ashish, P., Herb. No. GUBH P172; Banastari, Ponda Goa, 17/06/04, Pratibha, J., Herb. No. GUBH P172(a); Culture No. GUFCC No. 4907.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.2 cm in 7 days, circular, leathery, purplish-green, margin smooth, reverse dark green.

Two species of *Cercospora* i.e. *C. apii* and *C. hydrocotyles* are so far recorded from the host genus *Centella*. *Cercospora hydrocotyles* was isolated from two places from same host.

27. *Cercospora kikuchii* (Tak. Matsumoto & Tomoy.) M. W. Gardner, 1927. *Proc. natn. Acad. Sci. India*, Sect. B, Biol. Sci. 36: 12 (Fig.27a-c; 27d)

Fungus Hyphomycete. *Leaf spots* amphigenous, pale brown, circular, margin dark brown with white spot in the centre, 1-3 mm in diam, present entirely on the surface of the leaf. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, branched, septate, hyaline, smooth, thin walled, 1.5-2.5 µm wide hyphae; *Stroma* brown, spherical, 30-40 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large loose fascicles, erect, straight to slightly curved, unbranched, septate, smooth, pale olivaceous, 100-150 x 3.5-5.5 µm, with thickened and darkened, rim like conidial scars. *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, sympodial, determinate, integrated, cicatrized. *Conidia* solitary, simple, acropleurogenous, hyaline, scolecosporous, acicular, pluriseptate, smooth, 43-132.5 µm long, 2-3.5 µm wide at the broadest region, with thickened and darkened hilum.

Specimen examined: On living leaves of *Vigna unguiculata* (Linn.) Walp. (Papilionaceae), Banastari, Ponda Goa, 15/03/03, Herb. No. GUBH P25; Corjuvem,

Fig. 25a-c: *Cercospora gerberae*

25a- Leaf spots

25b- Conidiomata

25c- Conidium

Fig. 26a-c: *Cercospora hydrocotyles*

26a- Leaf spots

26b- Conidiomata

26c- Conidium

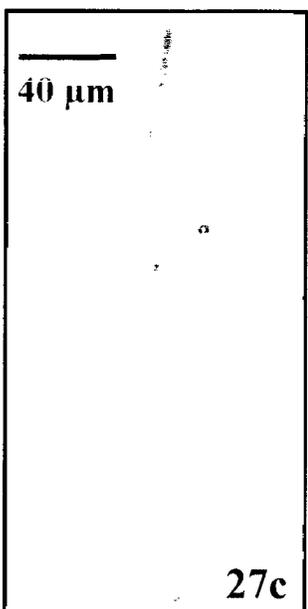
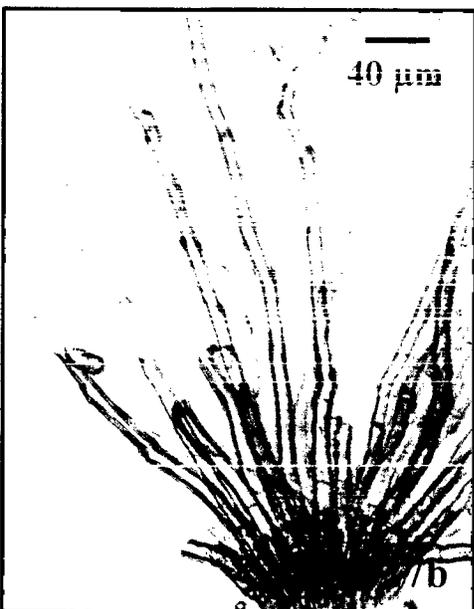
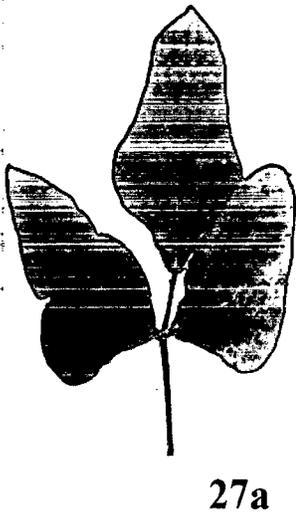
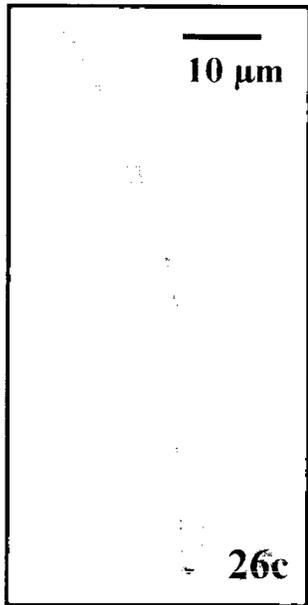
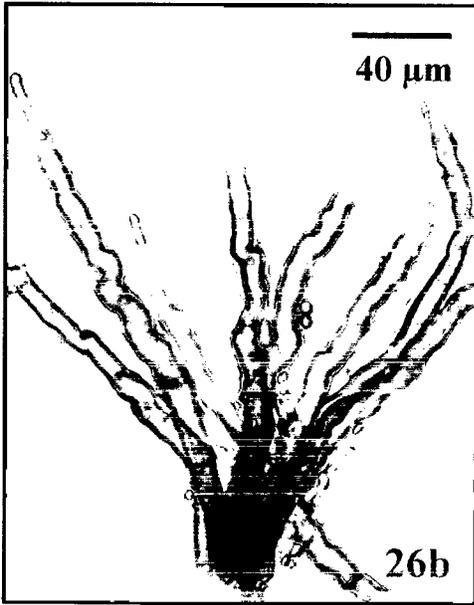
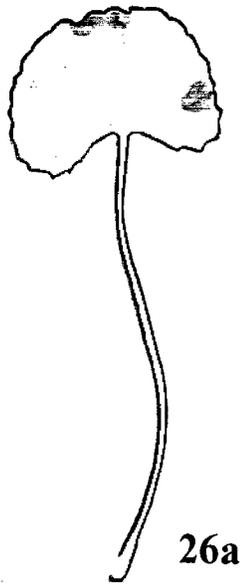
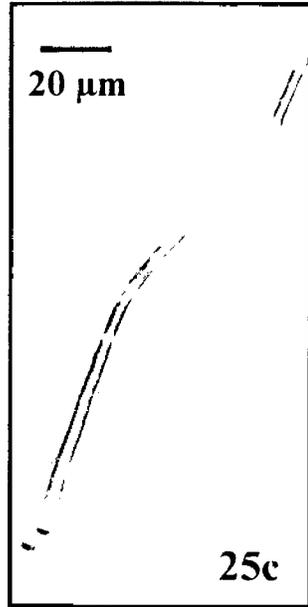
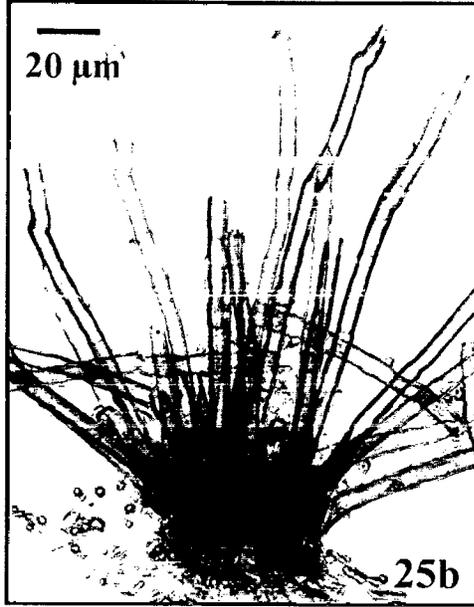
Fig. 27a-c: *Cercospora kikuchii*

27a- Leaf spots

27b- Conidiomata

27c- Conidium

Fig. 25-27



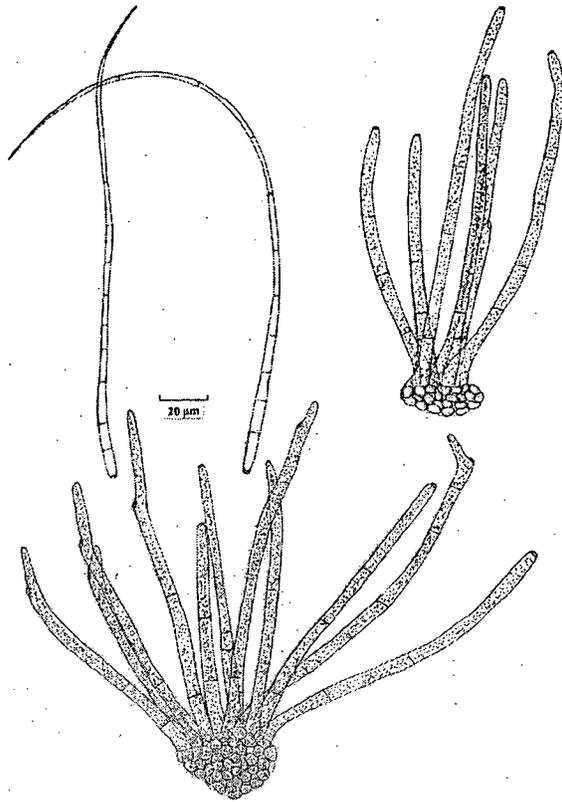


Fig. 25d *Cercospora gerberae*

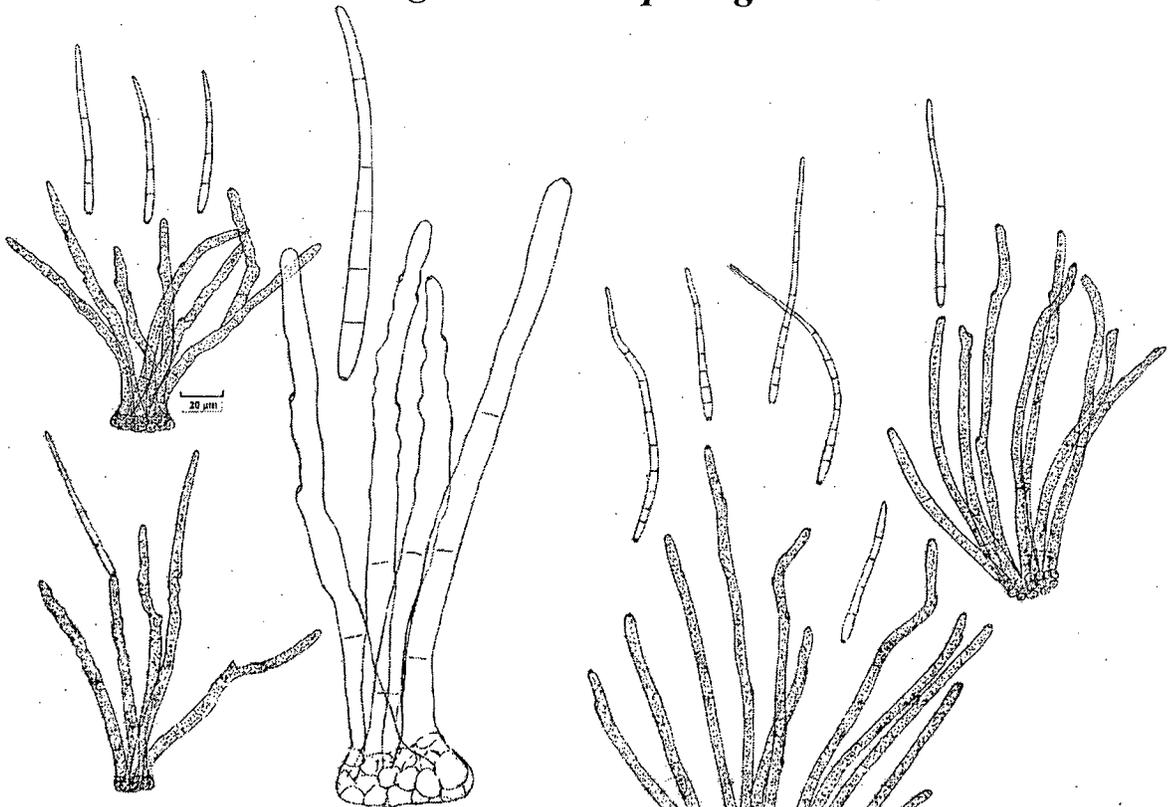


Fig. 26d *Cercospora hydrocotyles*

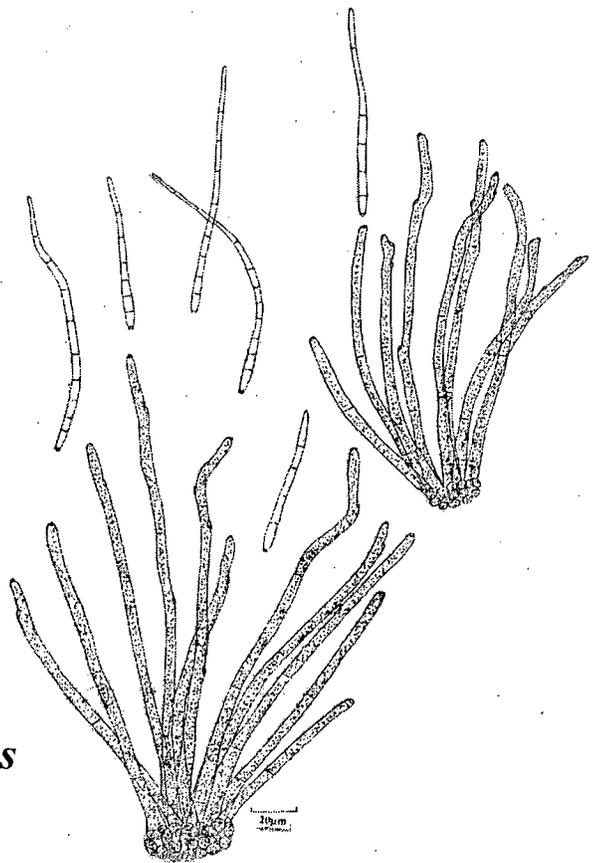


Fig. 27d *Cercospora kikuchii*

Bardez Goa, 31/05/03, Herb. No. GUBH P25; Caranzalem, Tiswadi Goa, 08/06/03, Herb. No. GUBH P25; Colem, Sanguem Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P25.

So far 14 species of *Cercospora*, viz. *C. canescens*, *C. cruenta*, *C. dolichi*, *C. kikuchii*, *C. longispora* (= *C. longissima*), *C. neovignae* (= *Pseudocercospora cruenta*), *C. raciborskii* (= *C. nicotianae*), *C. shihmenensis* (= *Pseudocercospora shihmenensis*), *C. vanderystii*, *C. vexillatae*, *C. vignae* (= *Pseudocercospora cruenta*), *C. vignae-vexillatae*, *C. vignicaulis* and *C. vignicola* (= *Corynespora casiicola*) are reported on the host genus *Vigna*. The isolated species showed similarity with *C. kikuchii* with respect to the shape and size of conidiophores and conidia. The fungus was isolated from the same host from four different localities indicating its specificity to the host plant.

28. *Cercospora mackenziei* sp. nov.

(Fig.28a-c; 28d)

Fungus Hyphomycete. *Leaf spots* amphigenous, gray, circular, 1-4 mm in diam., spots later collapses leaving shot holes. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, septate, light brown, thick-walled, 100-185 x 3-7 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, cicatrized, sympodial, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 60-135 μm long, 3-6.5 μm wide at broadest part, 1.5-2 μm at the pointed at tip, with thickened and darkened rim-like hilum.

Holotype: On living leaves of *Mackenzia integrifolia* (Dalz.) Bremek. (Acanthaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P101.

There are no records of *Cercospora* so far on host plant *Mackenzia integrifolia* from any parts of the world and therefore the fungus is treated as new species of the genus.

29. *Cercospora physalidis-minimae* Pavgi & U.P. Singh, 1965. *Mycopath. Mycol. appl.* 27: 92 (Fig.29a-c; 29d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, light brown, 3-5 mm in diameter, central portion later collapses. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, unbranched, 1-3 septate, light brown, thick-walled, 47-120 x 3.5-6.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 28-85 x 2.5-5 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Physalis minima* Linn. (Solanaceae), Calem, Sanguem Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P137.

Seven species of *Cercospora*, viz. *C. apii*, *C. diffusa* Ellis & Everh., *C. physalicola* Ellis & Barthol., *C. physalidicola* Speg., *C. physalidis* Ellis, *C. physalidis-angulatae* Yen & Gilles and *C. physalidis-minimae* Pavgi & Singh are so far reported from the *Physalis*.

30. *Cercospora timorensis* Cooke, 1883. *Grevillea*, 12: 38 (Fig.30a-c; 30d)

Fungus Hyphomycete. *Leaf spots* amphigenous, initially light brown later becoming dark brown with white spot in the center, circular, 2-3mm in diam.

Fig. 28a-c: *Cercospora mackenziei* sp. nov.

28a- Leaf spots

28b- Conidiomata

28c- Conidium

Fig. 29a-c: *Cercospora physalidis-minimae*

29a- Leaf spots

29b- Conidiomata

29c- Conidium

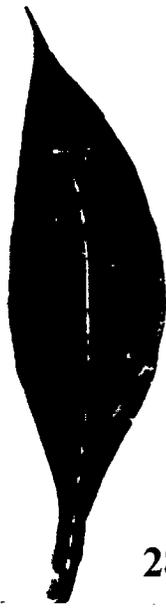
Fig. 30a-c: *Cercospora timorensis*

30a- Leaf spots

30b- Conidiomata

30c- Conidium

Fig. 28-30

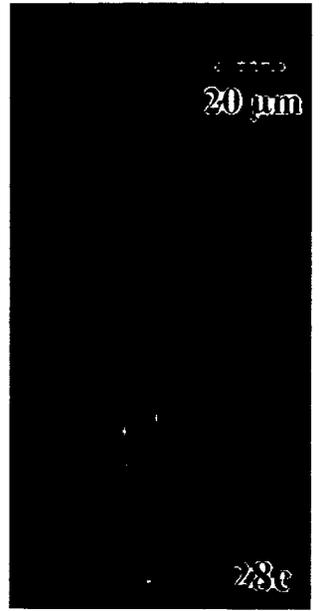


28a



20 μm

28b



20 μm

28c

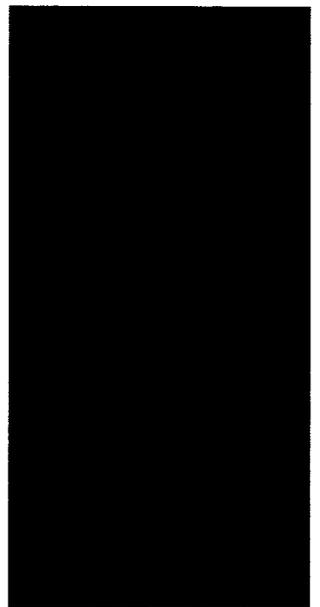


29a



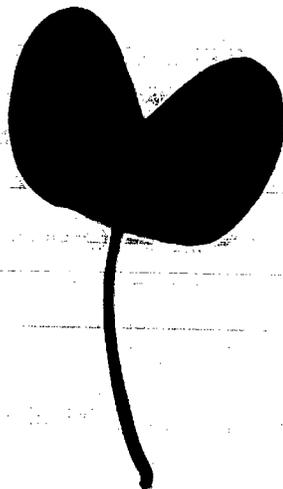
20 μm

29b



20 μm

29c

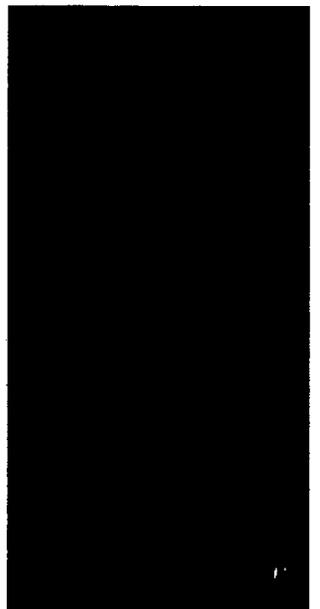


30a



20 μm

30b



20 μm

30c

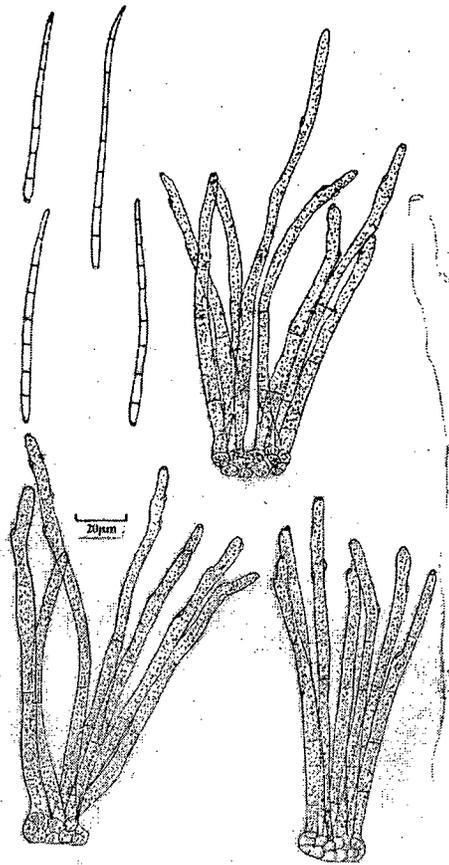


Fig. 28d *Cercospora mackenziei*

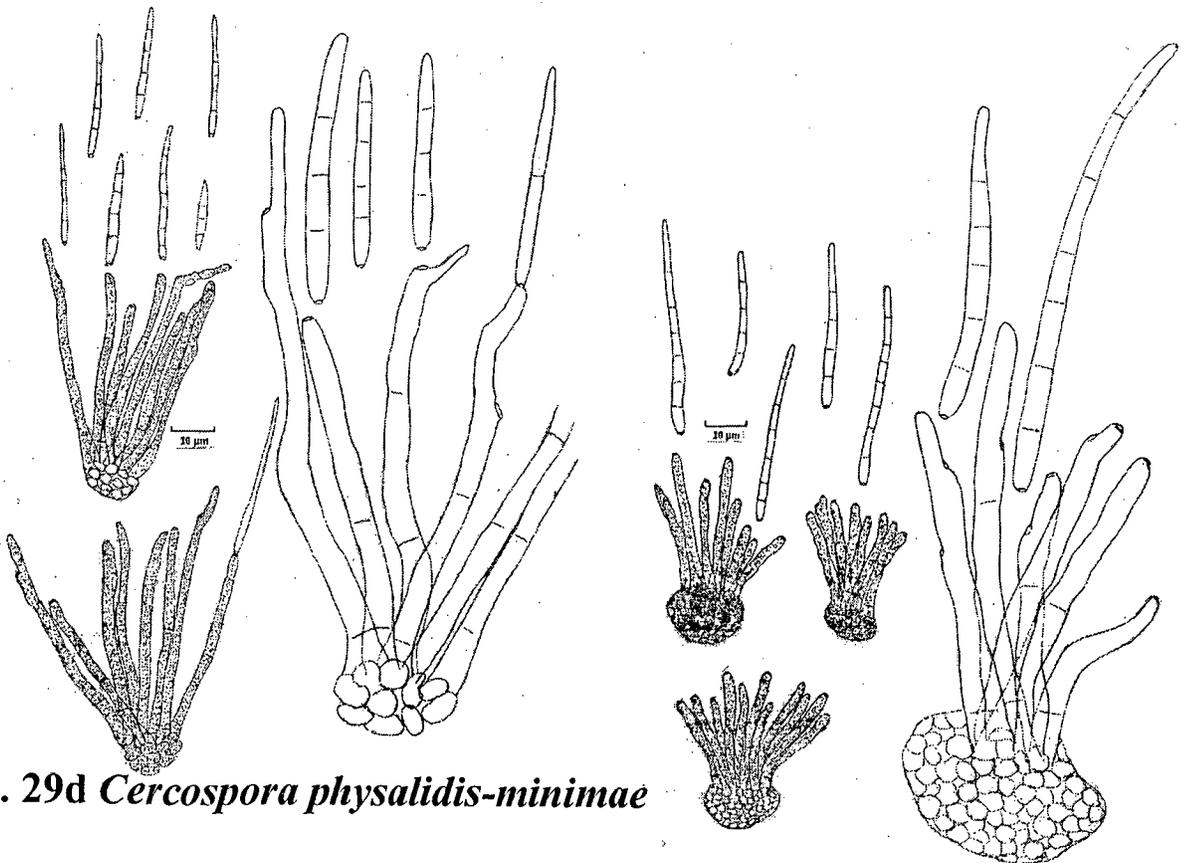


Fig. 29d *Cercospora physalidis-minimae*

Fig. 30d *Cercospora timorensis*

Colonies on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* well developed, dark brown, pseudoparenchymatous, spherical, 28-32 μm . *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, arising in dense fascicles, erect, straight, unbranched, septate, smooth, dark brown at the base, paler towards the apex, thick walled, 40-150 x 4-6 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, hyaline, pluriseptate, scolecosporous, sub-obtuse at the apex, truncate at the base, smooth, straight, 40-100 x 2-4.5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Ipomoeae biloba* Forsk. (Convolvulaceae) Campal, Panjim Goa, 15-08-03, Pratibha, J., Herb. No. GUBH P64.

So far 10 species of *Cercospora*, viz. *C. alabamensis* Atk., *C. haldibariensis*, *C. ipomoeae-purpureae*, *C. ipomoeae* G. Winter, *C. ipomoeae pes-caprae*, *C. ipomoeae – illustris*, *C. ipomoeae-indicae*, *C. stuckertiana*, *C. timorensis* and *C. varanasiensis* are reported from the host genus *Ipomoea*. The isolated species showed similarity with *C. timorensis* with respect to length of the conidiophore and conidia.

31. *Cercospora vanderystii* Henn., 1907. [as 'vanderysti'], *Annals de Musée du Congo*, Botanique Série 5 2(2): 104 (Fig.31a-c; 31d)

Fungus Hyphomycete. *Leaf spots* amphigenous, pale brown, circular, margin dark brown with white spot in the centre, 1-3 mm in diam, present on the entire leaf surface, most of the leaves in the field showed the infection. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* dark brown, spherical, 30-60 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in moderately large dense fascicles, erect, straight to slightly flexuous, unbranched,

septate, smooth, light brown, 27-127 x 3.5-6.5 μm , conidial scars thickened and darkened. *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, sympodial, determinate, integrated, cicatrized, with thickened and darkened conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, pluriseptate, hyaline, smooth, 40-150 x 3-6 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Vigna unguiculata* (Linn.) Walp. (Papilionaceae), Banastari, Ponda Goa, 15/03/03, Herb. No. GUBH P27; Corjuvem, Bardez Goa, 31/05/03, Herb. No. GUBH P27; Mashem, Cancona Goa, 10/10/04, Pratibha, J., Herb. No. GUBH P27.

So far 14 species of *Cercospora*, viz. *C. canescens*, *C. cruenta*, *C. dolichi*, *C. kikuchii*, *C. longispora* (= *C. longissima*), *C. neovignae* (= *Pseudocercospora cruenta*), *C. raciborskii* (= *C. nicotianae*), *C. shihmenensis* (= *Pseudocercospora shihmenensis*), *C. vanderystii*, *C. vexillatae*, *C. vignae* (= *Pseudocercospora cruenta*), *C. vignae-vexillatae*, *C. vignicaulis* and *C. vignicola* (= *Corynespora casiicola*) are reported on the host genus *Vigna*. The isolated species showed similarity with *C. vanderystii* with respect to the shape and size of conidiophores and conidia. The fungus was isolated from the same host from three different localities indicating its specificity to the host plant.

32. *Cercospora* sp. 1

(Fig.32a-c; 32d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular with concentric rings, dark brown, 2-6 mm in diam., spreading on entire leaf surface, central portion later collapses leaving the shot holes. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* spherical, dark brown, 22-27 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, 1-3 septate, olivaceous brown, thick-walled, 155-570 x 3.5-6.5 μm . *Conidiogenous cells* polyblastic,

Fig. 31a-c: *Cercospora vanderystii*

31a- Leaf spots

31b- Conidiomata

31c- Conidium

Fig. 32a-c: *Cercospora* sp.1

32a- Leaf spots

32b- Conidiomata

32c- Conidium

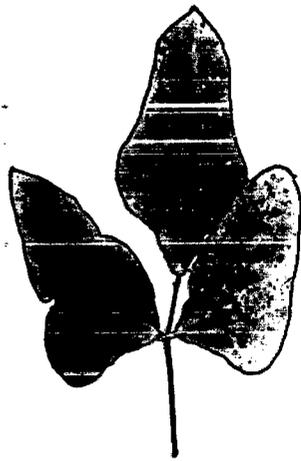
Fig. 33a-c: *Cercospora* sp.2

33a- Leaf spots

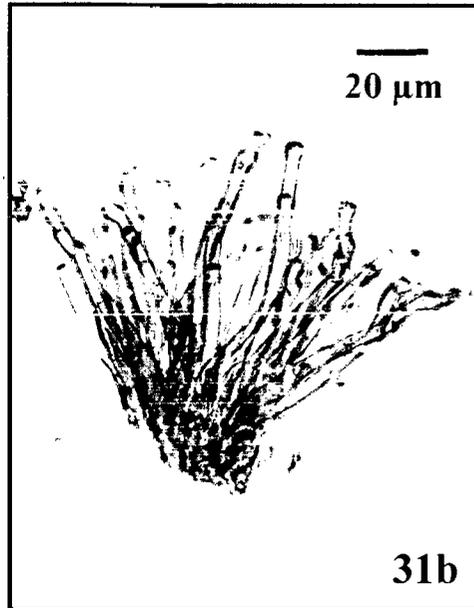
33b- Conidiomata

33c- Conidium

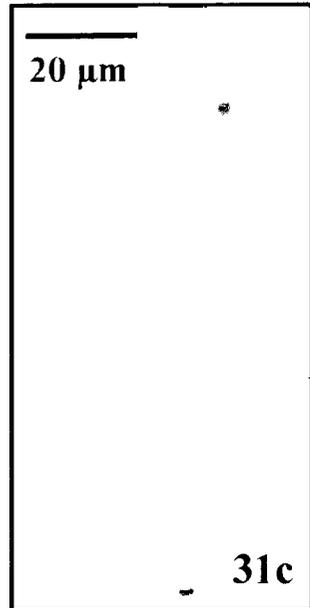
Fig. 31-33



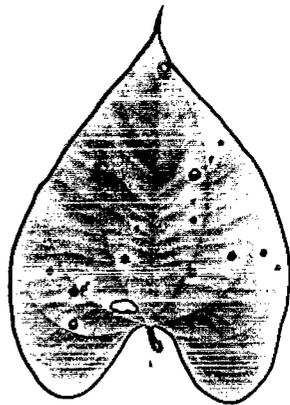
31a



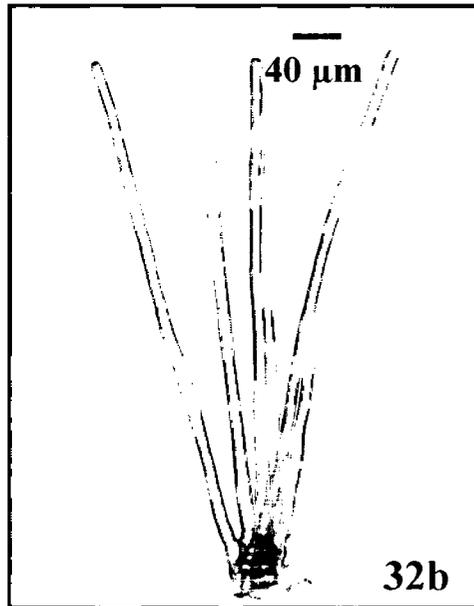
31b



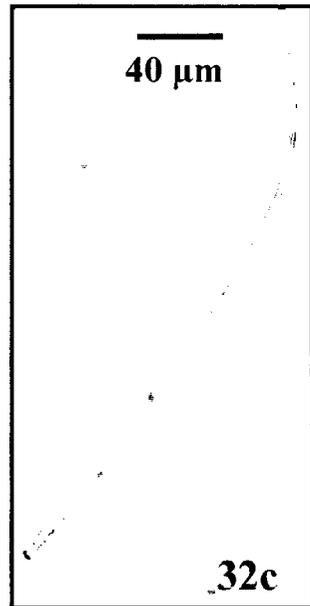
31c



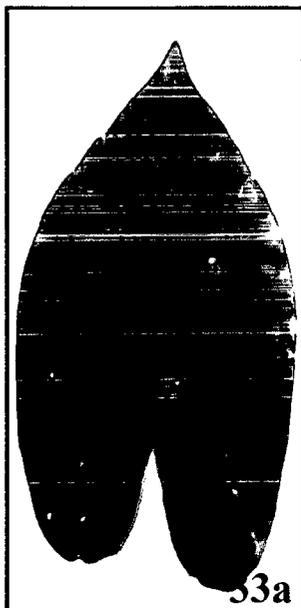
32a



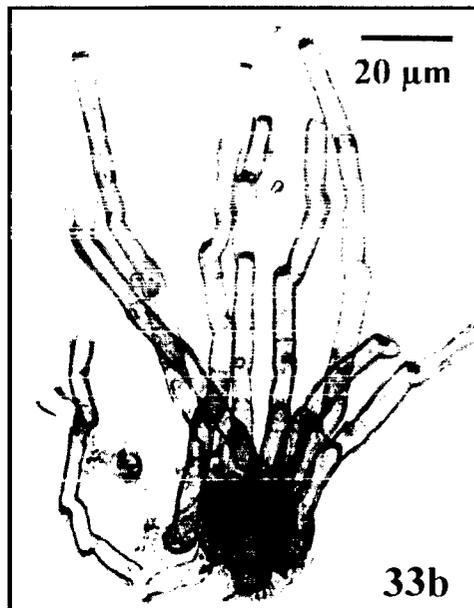
32b



32c



33a



33b



33c

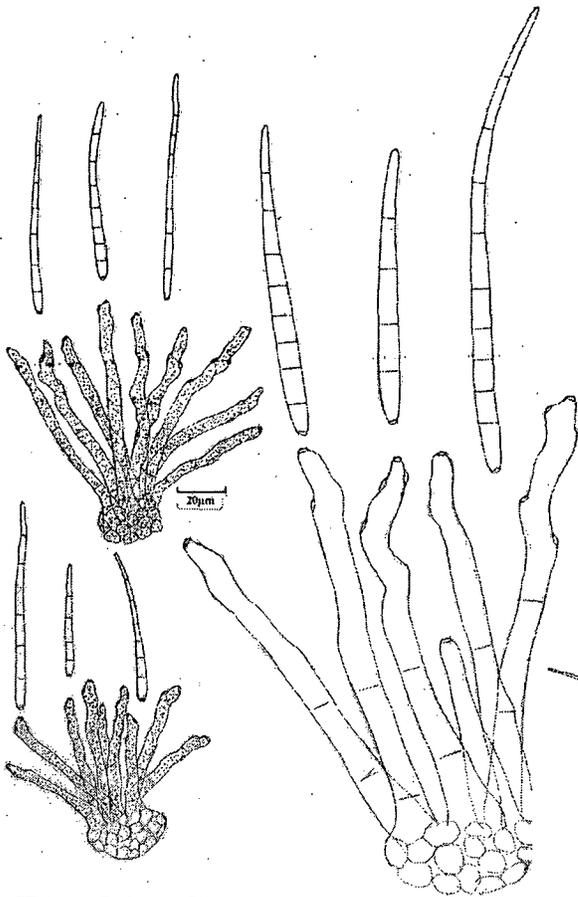


Fig. 31d *Cercospora vanderystii*

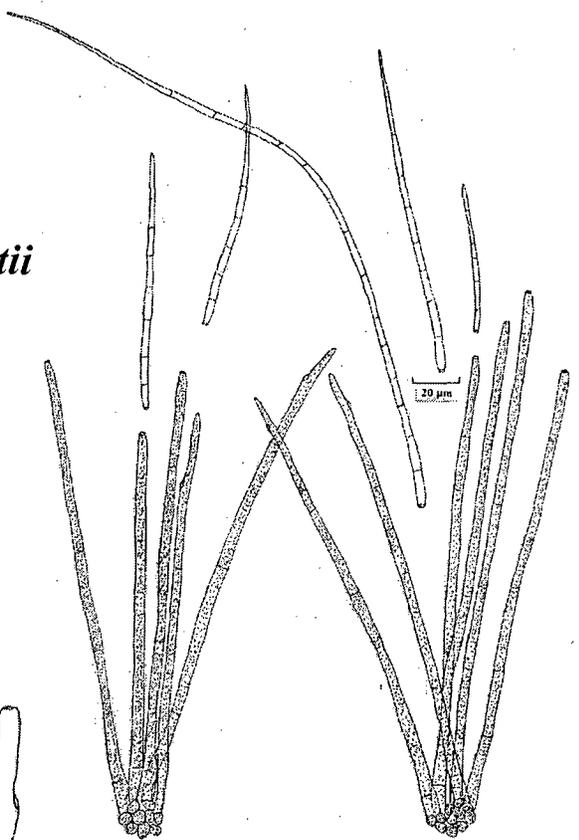


Fig. 32d *Cercospora* sp. 1

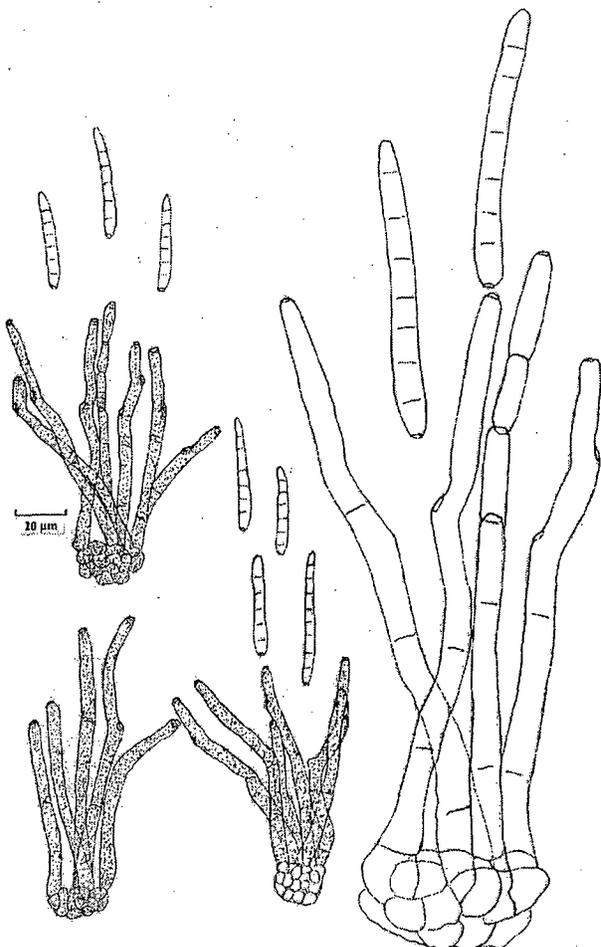


Fig. 33d *Cercospora* sp. 2

terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 90-215 x 3-5 μm with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Dioscorea bulbifera* Linn. (Dioscoriaceae), Banastari, Ponda Goa, 26/06/04, Herb. No. GUBH P141; Calem, Sanguem Goa, 22/10/04, Pratibha, J., Herb. No. GUBH P141(a).

33. *Cercospora* sp. 2

(Fig.33a-c; 33d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, light brown, 2-4 mm in diameter, spreading on entire leaf surface, the central portion later collapses leaving the shot hole. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, sometimes geniculate, smooth, unbranched, septate, olivaceous brown, thick-walled, 55-120 x 4-7 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 30-67 x 3.5-5.5 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Ipomoea* sp. (Convolvulaceae), Banastari, Ponda Goa, 16/07/04, Pratibha, J., Herb. No. GUBH P152.

34. *Cercospora* sp. 3

(Fig.34a-c; 34d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown, 2-3 mm wide, only one or two spots were observed on few leaves of the plant. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* spherical, dark brown, compact, 25-30 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores*

macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, 1-3 septate, brown, thick-walled, 37-67 x 4-7 μm . *Conidiogenous cells* mostly monoblastic, rarely polyblastic, terminal, integrated, determinate, cicatrized; with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 40-140 x 1.5-3 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Spermacose* sp. (Rubiaceae), Amboli, Sawantwadi, Maharashtra, India. 17/07/04, Pratibha, J., Herb. No. GUBH P158.

35. *Cercospora* sp. 4

(Fig.35a-c; 35d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown to black, with off white spot in the centre, 2-4 mm in diam., spreading on entire leaf surface. *Colonies* on leaf spots effuse, light brown, hairy. *Mycelium* immersed. *Stroma* dark brown, 18-25 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, septate, olivaceous brown, thick-walled, 20-145 x 3.5-605 μm . *Conidiogenous cells* mostly monoblastic, rarely polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, with conspicuous, thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to flexuous, pluriseptate, 50-190 x 4-7 μm , with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Ipomoea* sp. (Convolvulaceae), Banastari, Ponda Goa, 21/10/04, Pratibha, J., Herb. No. GUBH P177; Culture No. GUFCC No. 4908.

Fig. 34a-c: *Cercospora* sp.3

34a- Leaf spots

34b- Conidiomata

34c- Conidium

Fig. 35a-c: *Cercospora* sp.4

35a- Leaf spots

35b- Conidiomata

35c- Conidium

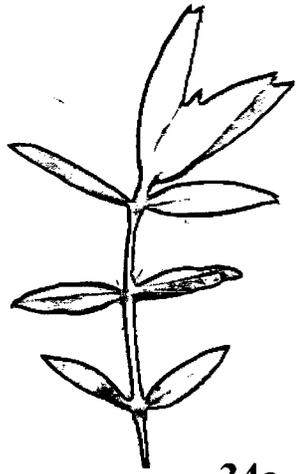
Fig. 36a-c: *Cercospora* sp.5

36a- Leaf spots

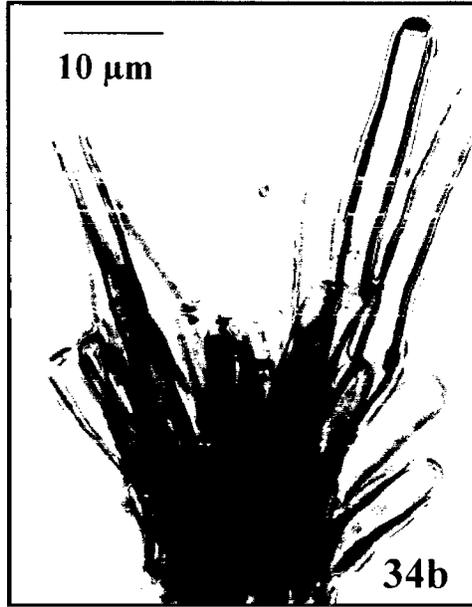
36b- Conidiomata

36c- Conidium

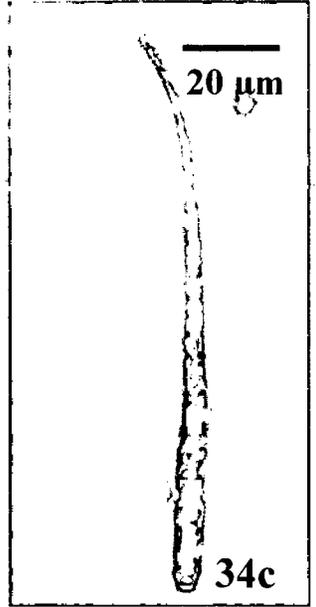
Fig. 34-36



34a



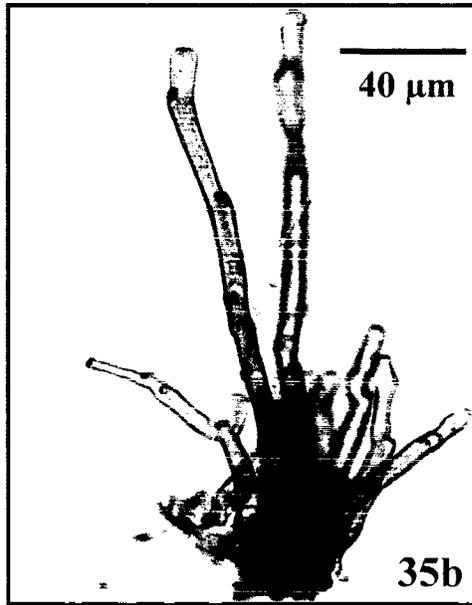
34b



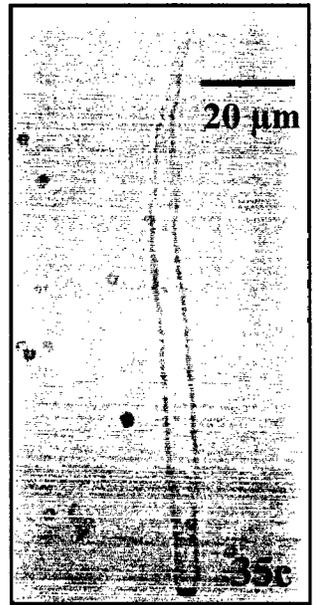
34c



35a



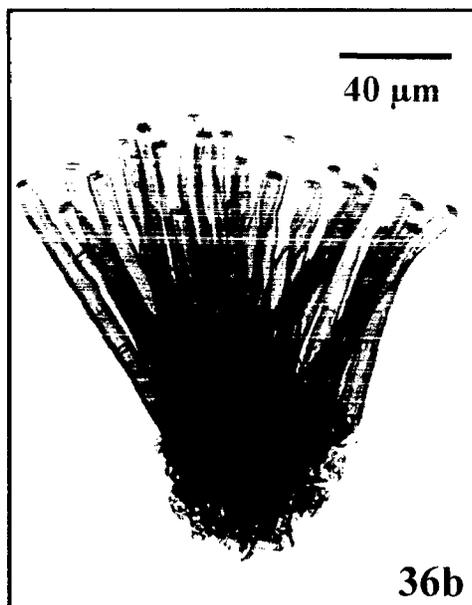
35b



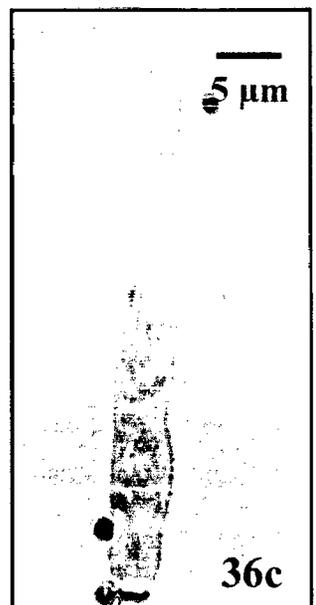
35c



36a



36b



36c

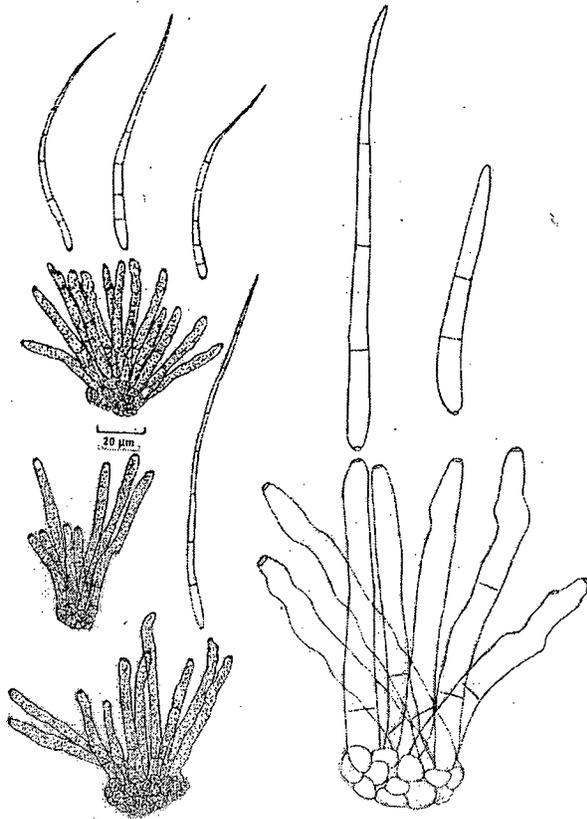


Fig. 34d *Cercospora* sp.3

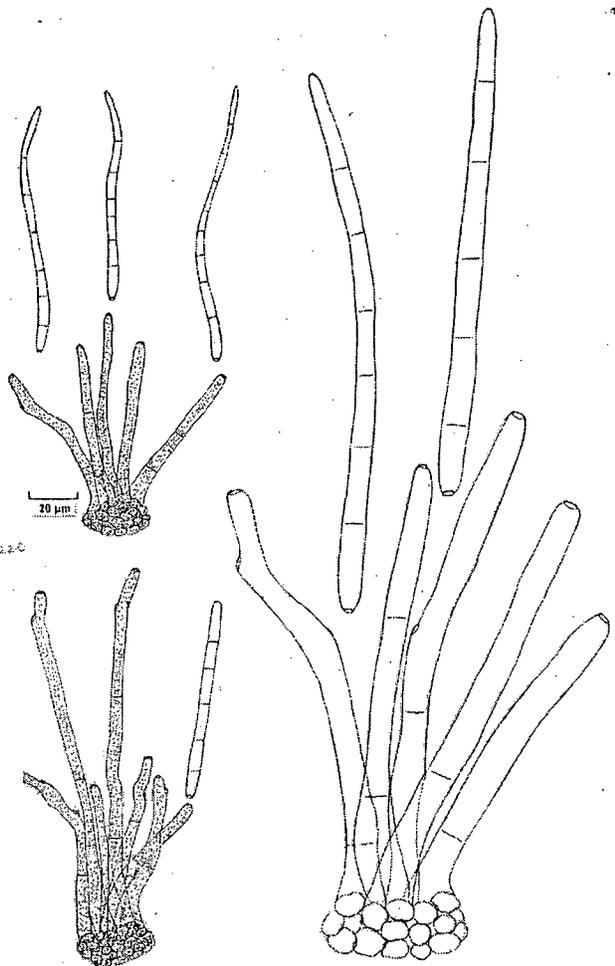


Fig. 35d *Cercospora* sp.4

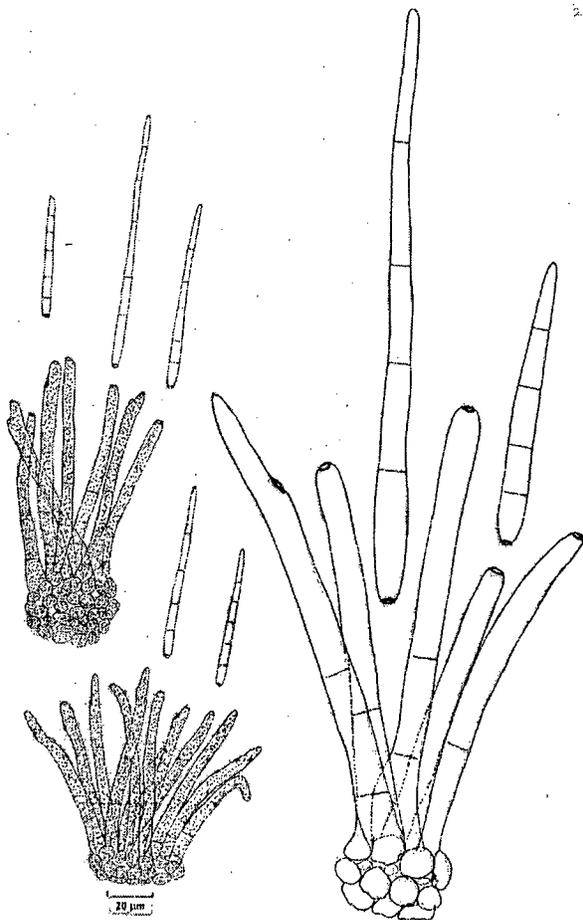


Fig. 36d *Cercospora* sp.5

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.8 cm in 7 days, circular, cottony, white, margin smooth, reverse off-white.

36. *Cercospora* sp. 5

(Fig.36a-c; 36d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, circular to semi-circular, sometimes forming concentric rings, 3-5 mm in diam. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* brown, spherical, 30-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large dense fascicles, erect, straight to flexuous, unbranched, septate, smooth, light brown, 40-80 x 3.5-5.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, determinate, sympodial, cicatrized, 16-25 x 6-8 μm , with conspicuous, thickened and darkened conidial scars. *Conidia* solitary, dry, simple, acropleurogenous, scolecosporous, filiform, hyaline, smooth, pluriseptate, 45-120 x 3-5 μm .

Specimen examined: On living leaves of *Cryptocorin* sp. (Araceae), Mashem, Cancona Goa, 13/02/04, Pratibha, J., Herb. No. GUBH P220.

37. *Cercospora* sp. 6

(Fig.37a-c; 37d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grayish brown, circular, sometimes irregular, 4-6 mm in diam, only one to two spots were observed on few leaves of the plant. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* brown, not well developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large dense fascicles, straight to flexuous, unbranched, septate, smooth, brown, with thickened and darkened conidial scars, 60-100 x 6-8 μm . *Conidiogenous cells* polyblastic, integrated, terminal,

later becoming intercalary, determinate, sympodial, cicatrized, 16-25 x 6-8 μm , with thickened and darkened conidial scars. *Conidia* solitary, dry, simple, acropleurogenous, hyaline, pluriseptate, scolecosporous, acicular, smooth, 40-120 x 3-4.5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Jasminum* sp. (Oleaceae), Banastari, Ponda Goa, 15/03/03, Herb. No. GUBH P22; Mashem, Cancona Goa, 16/10/04, Pratibha, J., Herb. No. GUBH P22.

38. *Cercospora* sp. 7

(Fig.38a-c; 38d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, grey in the centre with light brown margin, tiny about 1-2 mm in diameter, observed on almost entire leaf surface and most of the leaves in the field. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* yellowish, poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, light yellow, 95-260 x 4-6 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, hyaline, pluriseptate, scolecosporous, apex sub-obtuse, base truncate, smooth, straight, 40-192.5 x 3-5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Coccinia indica* (Linn.) Voigt. (Cucurbitaceae), Caranzalem, Tiswadi Goa, 08/06/03, Herb. No. GUBH P38; Banastari, Ponda Goa, 25/08/03, Pratibha, J., Herb. No. GUBH P38; Culture No. GUFCC No. 4909.

Fungus was cultured by infected tissue plating technique. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.9 cm in 7 days, circular, leathery, dark brown, margin smooth, reverse pinkish purple.

Fig. 37a-c: *Cercospora* sp.6

37a- Leaf spots

37b- Conidiomata

37c- Conidium

Fig. 38a-c: *Cercospora* sp.7

38a- Leaf spots

38b- Conidiomata

38c- Conidium

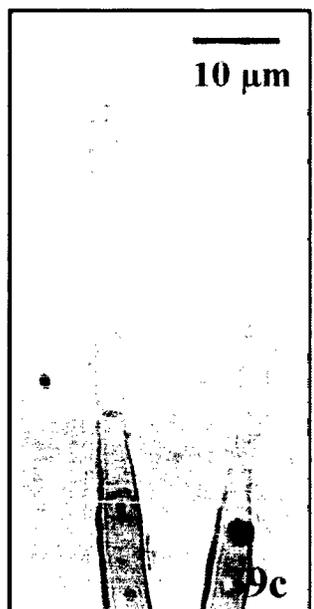
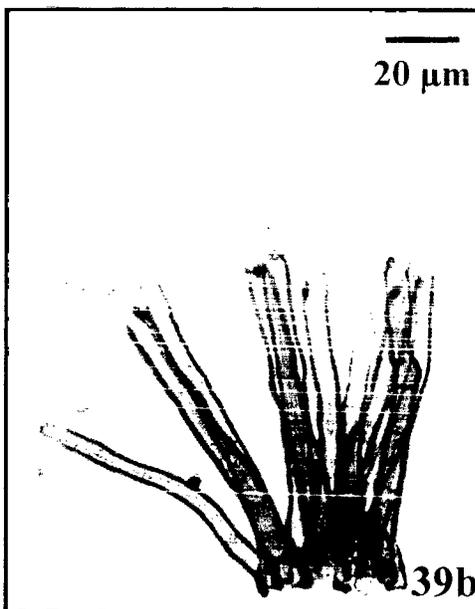
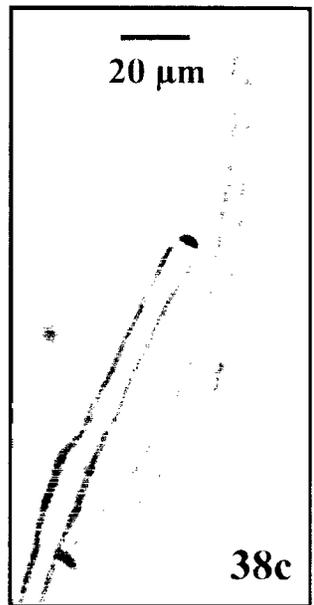
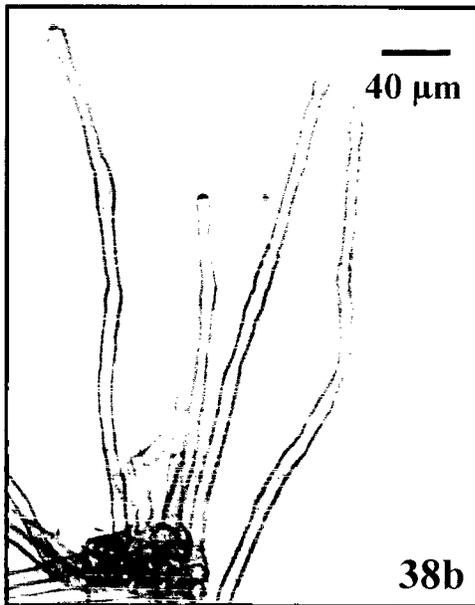
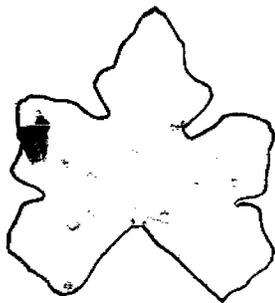
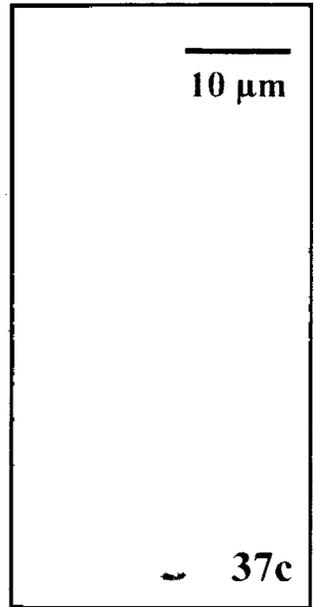
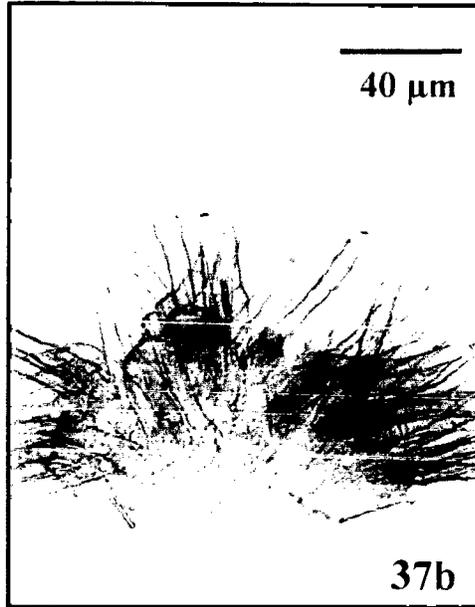
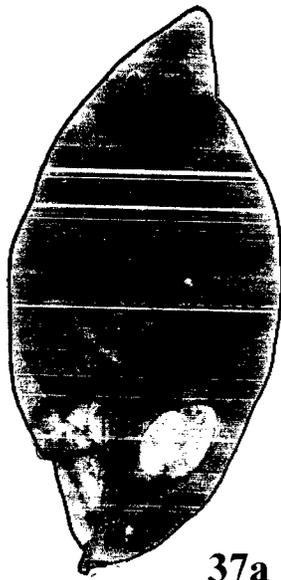
Fig. 39a-c: *Cercospora* sp.8

39a- Leaf spots

39b- Conidiomata

39c- Conidium

Fig. 37-39



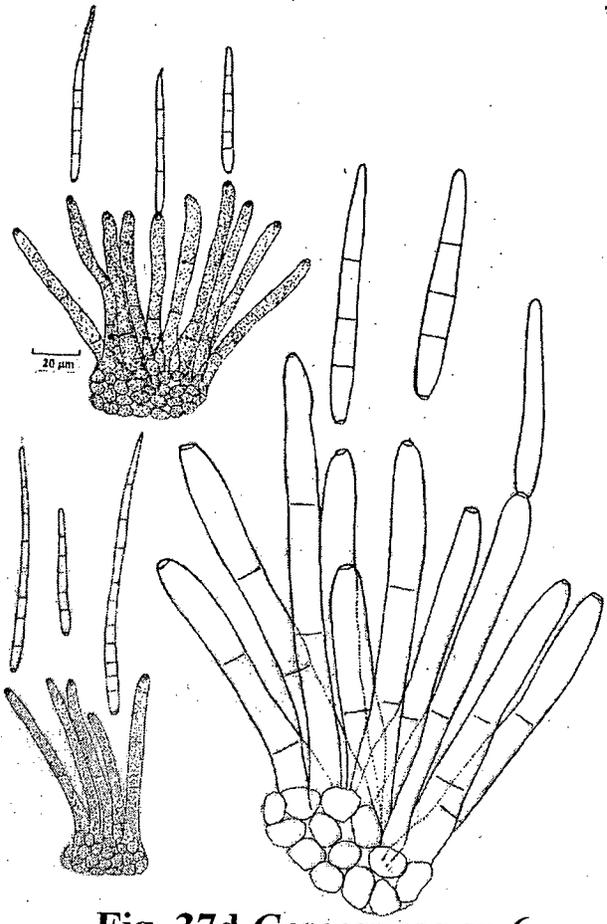


Fig. 37d *Cercospora* sp.6

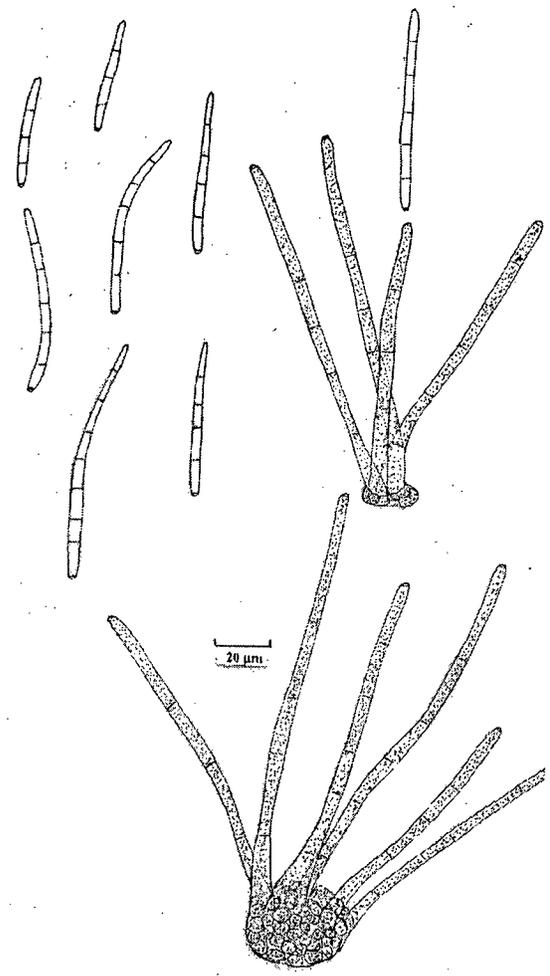


Fig. 38d *Cercospora* sp.7

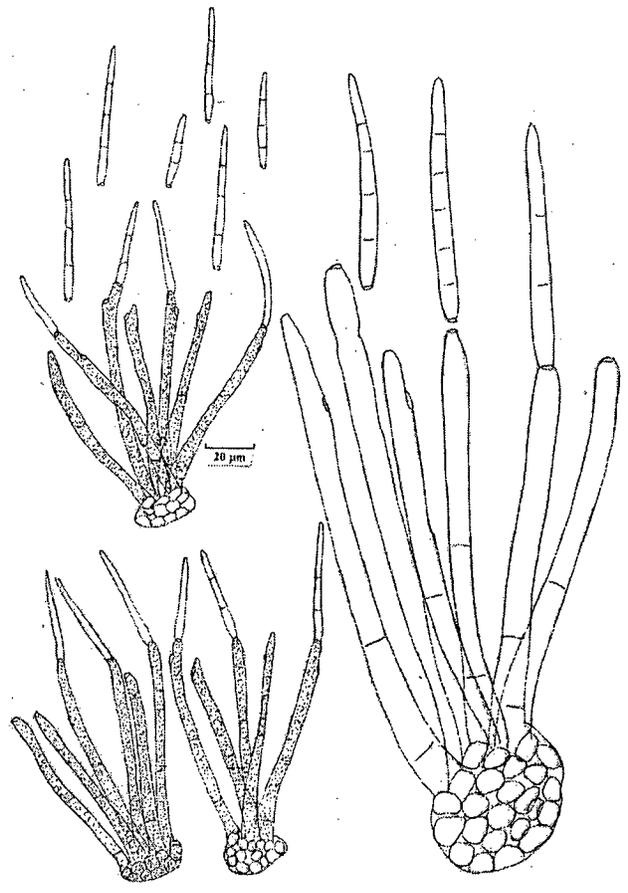


Fig. 39d *Cercospora* sp.8

39. *Cercospora* sp. 8

(Fig.39a-c; 39d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* dark brown, pseudoparenchymatous, loosely arranged, 30-35 μm . *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large fascicles, erect, straight, unbranched, septate, smooth, dark brown at the base, paler towards the apex, thick walled, 70-98 x 4-7.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, with thickened and darkened, rim like conidial scars. *Conidia* solitary, simple, acropleurogenous, hyaline, pluriseptate, scolecosporous, sub-obtuse at the apex, rounded at the base, smooth, straight to slightly flexuous, 35-100 x 3-4.5 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Cucumis trigonus* Roxb. (Cucurbitaceae), University Campus, Taleigao Goa, 28/08/03, Pratibha, J., Herb. No. GUBH P68.

40. *Cercospora* sp. 9

(Fig.40a-c; 40d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black with grayish in the centre, circular, sometimes irregular, 4-8 mm wide. *Colonies* on leaf spots effuse. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, many-septate, light brown, thick-walled, 160-315 x 3.5-7 μm . *Conidiogenous cells* polyblastic, terminal as well as intercalary, integrated, determinate, cicatrized, sympodial, with thickened and darkened conidial scars. *Conidia* solitary, simple, acropleurogenous, smooth, hyaline, straight to flexuous, 85-400 μm long, 3-5 μm wide at broadest part, 1.5-2 μm at the pointed tip, truncate at the base, with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Paracaryum* sp. (Baraginaceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Herb. No. GUBH P80; Valpoi, Sattari Goa, 08/08/04, Pratibha, J., Herb. No. GUBH P80, Culture No. GUFCC No. 4910.

The fungus was cultured by infected tissue plating technique. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.4 cm in 7 days, circular, leathery, light green, margin smooth, reverse dark green.

41. *Cercospora* sp. 10

(Fig.41a-c; 41d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, brown with off white in the centre, later the central portion collapses leaving the shot holes, 3-5 mm in diam., observed on entire leaf surface. *Colonies* on leaf spots effuse, light brown. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous fasciculate, erect, straight to flexuous, unbranched, septate, brown at the base, paler towards the tip, thick walled, 27-98 x 3.5-7 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, cicatrized, sympodial, conidial scars thickened and darkened, rim-like. *Conidia* solitary, smooth, acropleurogenous, scolecosporous, hyaline, pluriseptate, sigmoid, pointed at the apex, truncate at the base, 60-170 μm x 2-5 μm .

Specimen examined: On living leaves of *Amorphophallous campanulatus* Decne. (Araceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P81.

42. *Cercospora* sp. 11

(Fig.42a-c; 42d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white to grayish in the centre with dark brown to black margin, circular in the form of concentric rings, 2-7 mm in diam. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* poorly developed, brown. *Setae* and *hyphopodia* absent. *Conidiophores*

Fig. 40a-c: *Cercospora* sp.9

40a- Leaf spots

40b- Conidiomata

40c- Conidium

Fig. 41a-c: *Cercospora* sp.10

41a- Leaf spots

41b- Conidiomata

41c- Conidium

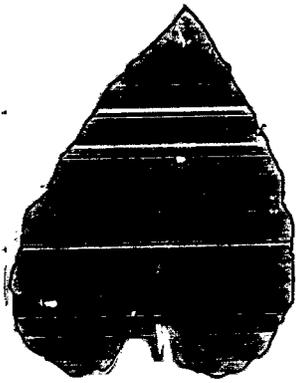
Fig. 42a-c: *Cercospora* sp.11

42a- Leaf spots

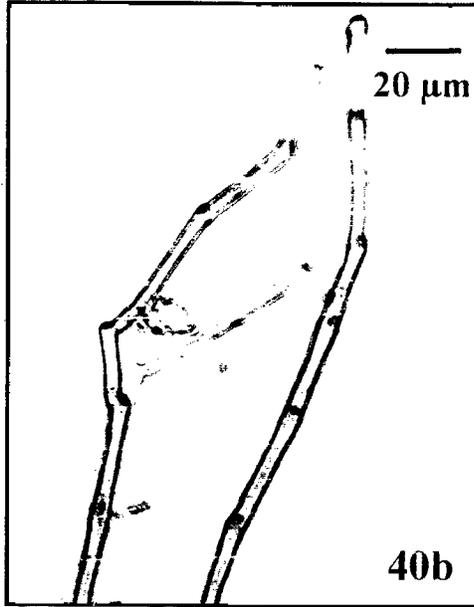
42b- Conidiomata

42c- Conidium

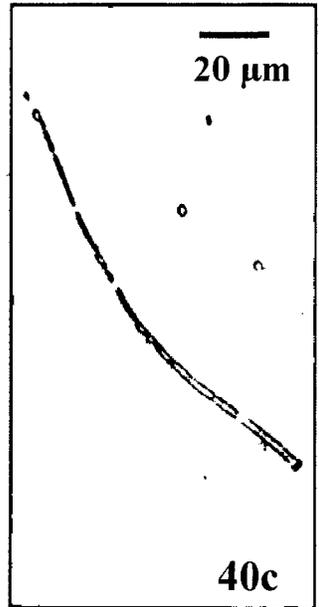
Fig. 40-42



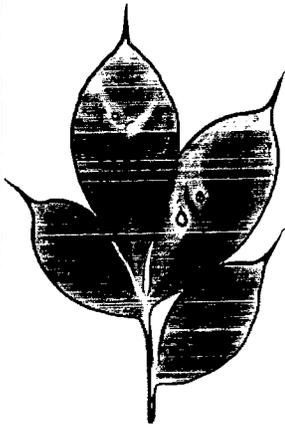
40a



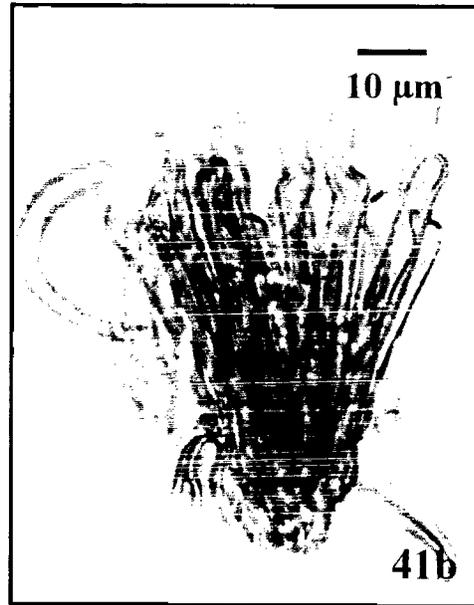
40b



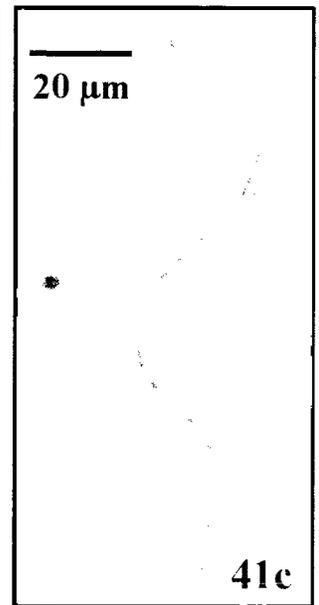
40c



41a



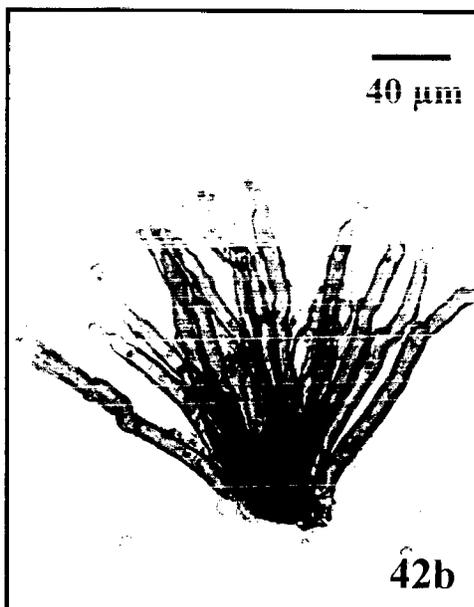
41b



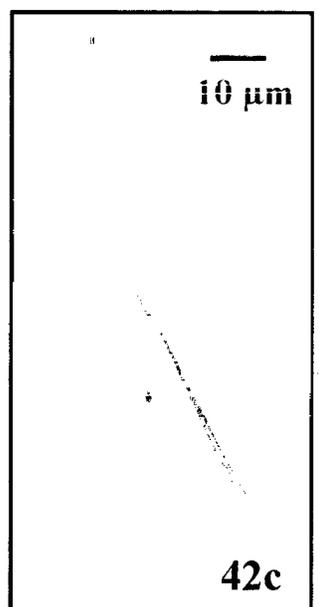
41c



42a



42b



42c

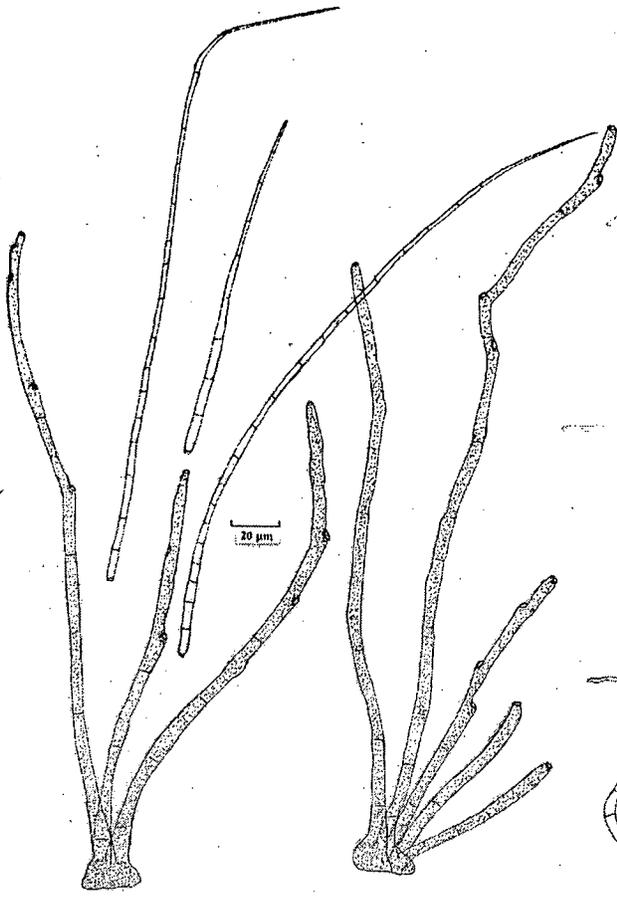


Fig. 40d *Cercospora* sp.9

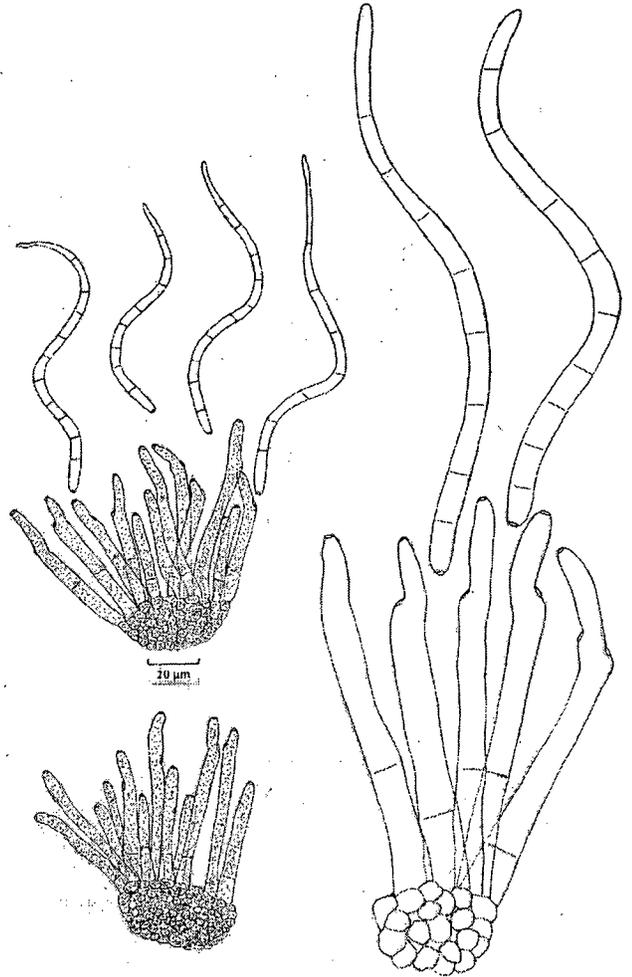


Fig. 41d *Cercospora* sp.10

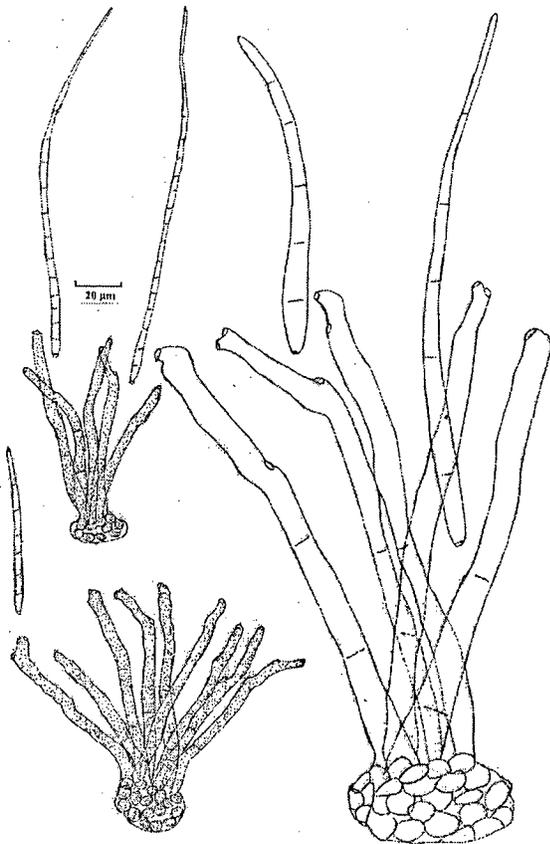


Fig. 42d *Cercospora* sp.11

macronematous, mononematous, in loose fascicles, erect, straight to flexuous, smooth, unbranched, septate, dark brown at the base, paler towards the tip, thick-walled, 35-109 x 3.5-7 µm. *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, cicatrized, sympodial with thickened and darkened conidial scars. *Conidia* solitary, simple, acropleurogenous, scolecosporous, acicular, smooth, hyaline, straight to slightly flexuous, pluriseptate, 60-195 µm long, 2-4 µm wide at broadest part, 1-1.5 µm at the pointed at tip, with thickened and darkened rim-like hilum.

Specimen examined: On living leaves of *Impatiens pulcherrima* Dalz. (Balsaminaceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Herb. No. GUBH P84; Calem, Sanguem Goa, 10/11/04, Pratibha, J., Herb. No. GUBH P84.

The above 11 species of *Cercospora* were not identified and assigned to their respective species, in view of absence of adequate reference material at this stage.

43. *Chaetopsina indica* sp. nov.

(Fig.43a-c; 43d)

Fungus Hyphomycete. *Leaf spots* amphigenous, brown, in the form of large patches covering almost half of the leaf surface, mostly seen along the margin of the leaves. *Colonies* on leaf spots effuse, pale brown, hairy. *Mycelium* immersed. Stroma none. *Setae* absent. *Hyphopodia* absent. Conidiophores macronematous, erect, straight to flexuous, smooth, dark brown, thick-walled, septate, setiform, 200-250 x 5-7.5 µm, apex sterile, pointed. *Conidiogenous cells* monophialidic, discrete, determinate, ampuliform, formed on main axis, light yellow, 3.5-7 x 3-4 µm, without a conspicuous collarette. *Conidia* aggregated in slimy masses, simple, smooth, hyaline, aseptate, obclavate, rounded at the apex, pointed at the base, 5.5-7 x 2-3.5 µm.

Holotype: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P95.

The genus *Chaetopsina* Rambelli (Ellis, 1971), typified by *C. fulva* Rambelli, has about 20 species so far described. These are litter-inhabiting fungi known from all over the world. The fungus described here is recognised as a new species of the genus in view of its obclavate conidia that are rounded at the apex and pointed at the base. This is also the first report of the representative of the genus as a foliicolous inhabitant.

44. *Chalara indica* Pratibha, K.D. Hyde et Bhat. 2005. *Cryptogamie Mycologie*. 26 (2): 97-103 (Fig.44a-c; 44d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to sub-circular, sometimes irregular, brown, 0.7-2 cm in diam., occurring on entire leaf surface and the infection was observed on most of the leaves. *Colonies* effuse, brown, composed of immersed mycelium with branched, septate, 2-3 μm wide hyphae; *Conidiophores* fasciculate, mononematous, brown, 1-3-septate, unbranched, smooth, 70-170 \times 6-10 μm . *Conidiogenous cells* phialidic, percurrently regenerating, pale to moderately brown, smooth, 55-70.5 μm long. *Venter* round to sub-cylindrical, 32.5-40 μm long, 11-16.5 μm wide at the broadest part. *Collarette* cylindrical, 25-32.5 \times 8-10 μm . *Conidia* slimy, endogenous, hyaline, cylindrical, smooth, aseptate, rounded at apex, truncate at the base, 20-30 \times 5-6.5 μm , developing in basipetal chains.

Specimen examined: On living leaves of *Areca catechu* Linn. (Arecaceae), Kesarwal, Goa, 12/07/03, Herb. No. GUBH P49; Banastari, Ponda Goa, 06/06/04, Herb. No. GUBH P49; Mashem, Cancona Goa, 16/10/04, Pratibha, J., Herb. No. GUBH P49.

Of the nearly 100 so far known species in the genus, typified by *C. fusidioides* (Cda) Rabenhorst, *C. indica* may be compared with *C. microchona* Gams (Gams and Holubova-Jechova, 1976) for its regenerating phialides and *C. sibika* Subram. and Sudha (Subramanian and Sudha, 1986) for conidial dimensions. However, in *C. microchona* the phialides regenerate sympodially and the conidia are 3.5-5 \times 1.3-2.5

Fig. 43a-c: *Chaetopsina indica*

43a- Leaf spots

43b- Conidiomata

43c- Conidia

Fig. 44a-c: *Chalara indica*

44a- Leaf spots

44b- Conidiophore with conidium

44c- Conidia

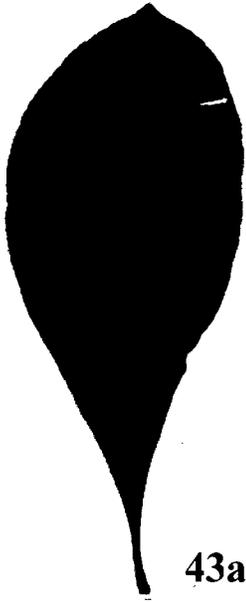
Fig. 45a-c: *Cladosporium caryotii* sp. nov.

45a- Leaf spots

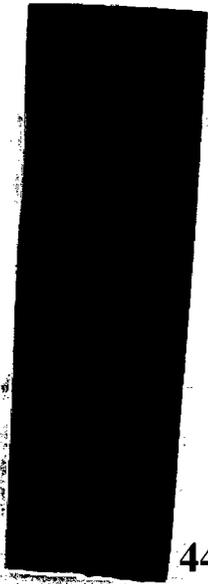
45b- Conidiomata

45c- Conidiophores and conidia

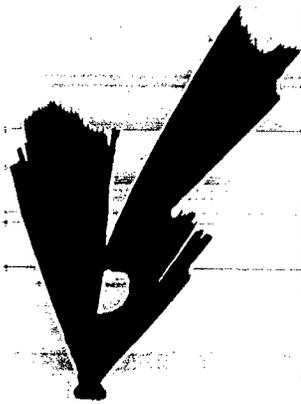
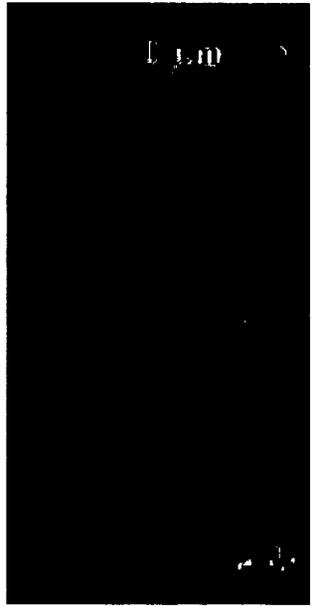
Fig. 43-45



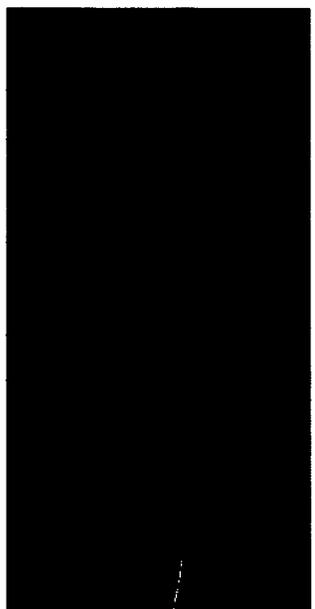
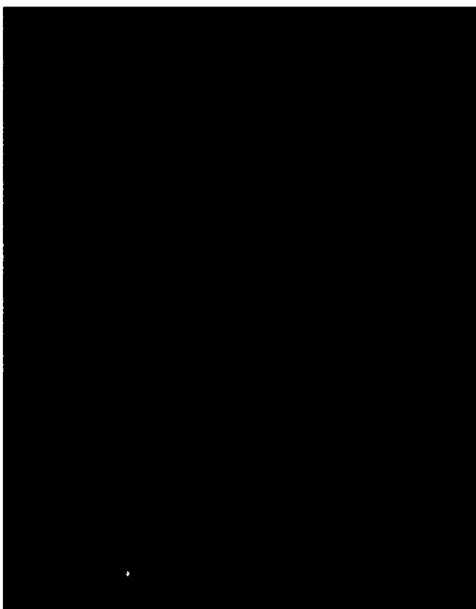
43a



44a



45a



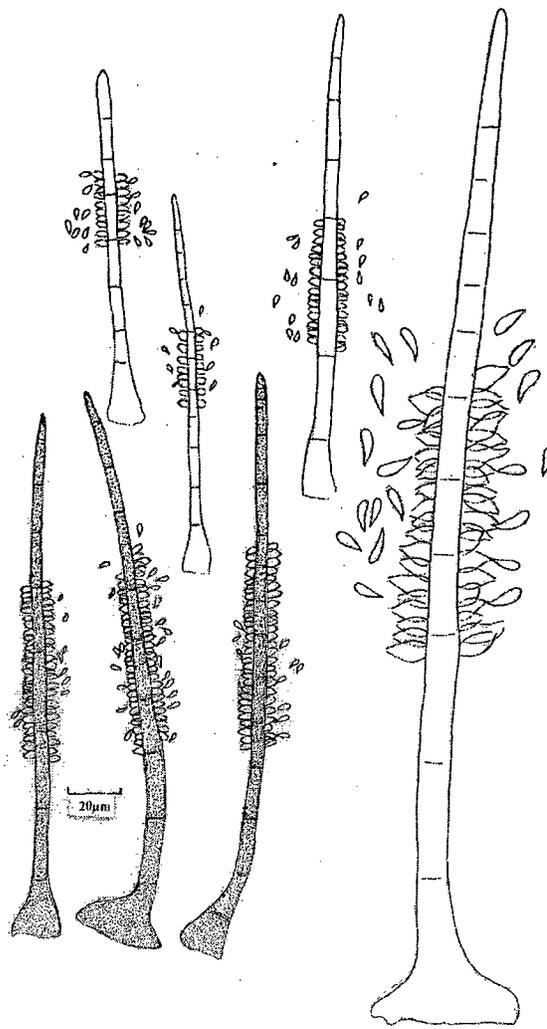


Fig. 43d *Chaetopsina indica*

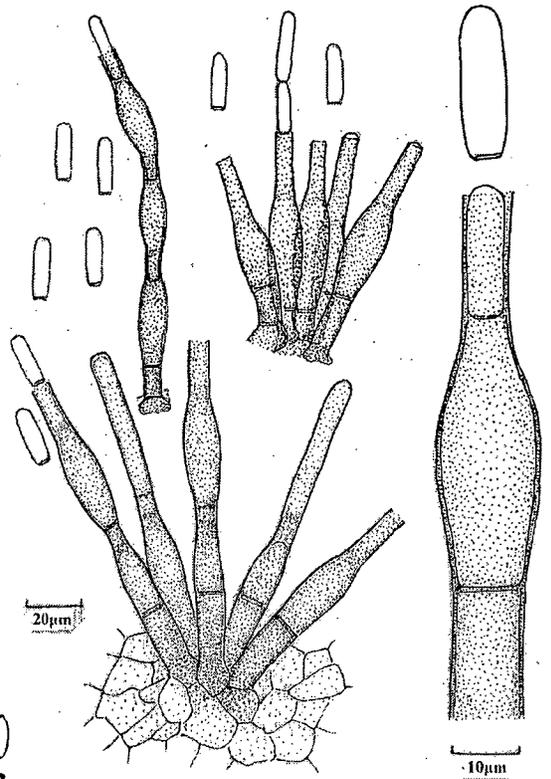


Fig. 44d *Chalara indica*

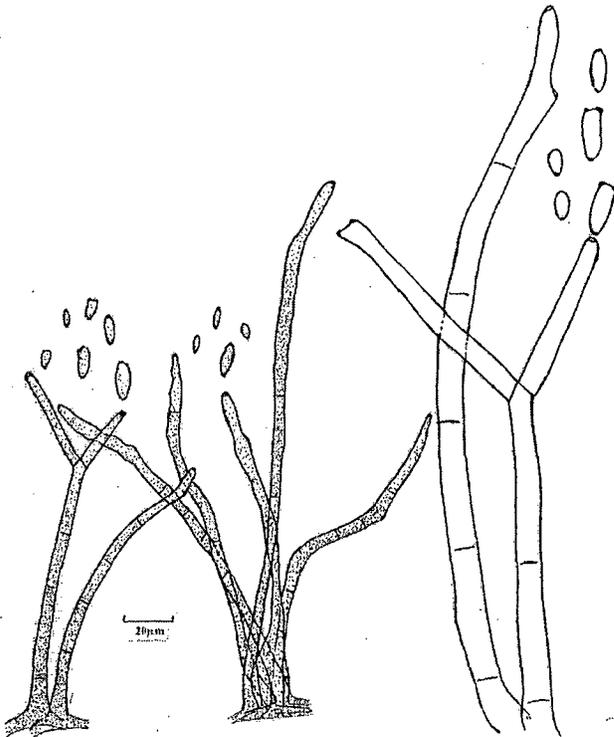


Fig. 45d *Cladosporium caryotii*

μm . In *C. sibika*, the cylindrical conidia are truncate at both ends and measure $12.1-26.4 \times 2.5-3.3 \mu\text{m}$. Further, the first-formed conidia in *C. sibika* are turbinate ($6.5-9.5 \times 4.8-6$), whereas the conidia in *C. indica* are undifferentiated.

45. *Cladosporium caryotii* sp. nov.

(Fig.45a-c; 45d)

Fungus Hyphomycete. *Leaf spots* amphigenous, greyish brown, circular to semi-circular, sometimes irregular, 1-3 mm in diam. *Colonies* on leaf spots effuse, dark green, hairy. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, smooth, branched, septate, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, unbranched to sometimes branched, septate, smooth, olivaceous brown, thick-walled, $100-170 \times 4-6 \mu\text{m}$. *Conidiogenous cells* monoblastic, integrated, terminal, later becoming intercalary, determinate, sympodial, cicatrized, with prominent scars. *Conidia* catenate, dry, simple, acropleurogenous, ellipsoidal, olivaceous brown, 0-1-septate, smooth, $6-20 \times 4-6.5 \mu\text{m}$.

Holotype: On living leaves of *Caryota urens* Linn. (Arecacera) Cotiga, Canacona Goa, 13/02/04, Pratibha, J., Herb. No. GUBH P225.

46. *Cladosporium semicarpie* sp. nov.

(Fig.46a-c; 46d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular, sometimes circular, 4-5 mm wide. *Colonies* on leaf spots effuse, olivaceous brown, hairy. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, smooth, branched, septate, 2-3 μm wide hyphae, *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, branched at the apical region forming heads, septate, light brown, thick-walled, $135-255 \times 3-4 \mu\text{m}$. *Conidiogenous cells* polyblastic, terminal, discrete, determinate, cicatrized, with conspicuous conidial scars, $8-10 \times 2-3 \mu\text{m}$. *Conidia*

catenate, in branched chains, dry, ellipsoidal, sub-hyaline, acropleurogenous, smooth, aseptate, with scars at both ends, 4-6.5 x 2-3 µm.

Holotype: On living leaves of *Semicarpus anacardium* Linn. (Anacardiaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P209.

Species of *Cladosporium* are ubiquitous in distribution. They are mostly known as litter inhabitants. Often one would encounter them even as lab contaminants. Ellis (1971, 1976) recorded a sufficiently large number of species in the genus as foliicolous. In the absence of record of any hitherto species of the genus on *Semicarpus anacardium* and *Caryota urens*, the isolated taxa are designated as new species of the genus.

47. *Cordana musae* (Zimm.) Hohn. Zentbl. Bakt. ParasitKde, Abt. II 2 (60): 7 (1923)

(Fig.47a-c; 47d)

Fungus Hyphomycete. Leaf spots amphigenous, grey, irregular large patches with brown margin. Colonies effuse, grayish brown, mycelium partly immersed, partly superficial, composed of hyaline, branched, smooth, septate, 2-3 µm wide hyphae. Conidiophores macronematous, mononematous, solitary, straight to flexuous, pale brown, smooth, unbranched, septate, often nodose, usually swollen at the base, 100-200 × 4-7 µm. Conidiogenous cells polyblastic, integrated, terminal, later becoming intercalary, denticulate, denticles small, cylindrical. Conidia solitary, on small pegs arising from terminal swellings which later becomes intercalary, obovoid to pyriform, 1-septate, sometimes slightly constricted at the septum, pale brown, smooth, rounded at apex, truncate at the base, 12-20 × 6-10 µm.

Specimen examined: On living leaves of *Musa paradisiaca* Linn. (Musaceae), Sigao, Goa, 13/07/03, Pujá G., Herb. No. GUBH P51; Banastari, Ponda Goa, 25/09/04, Pratibha, J., Herb. No. GUBH P51.

Fig. 46a-c: *Cladosporium semicarpie* sp. nov.

46a- Leaf spots

46b- Conidiomata

46c- Conidiophore with conidia

Fig. 47a-c: *Cordana musae*

47a- Leaf spots

47b- Conidiomata

47c- Conidiophores with conidia

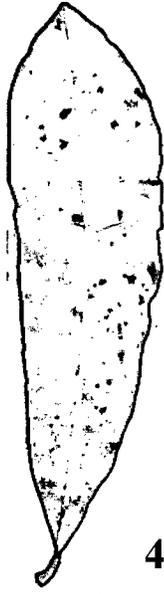
Fig. 48a-c: *Corynespora calicioidea*

48a- Leaf spots

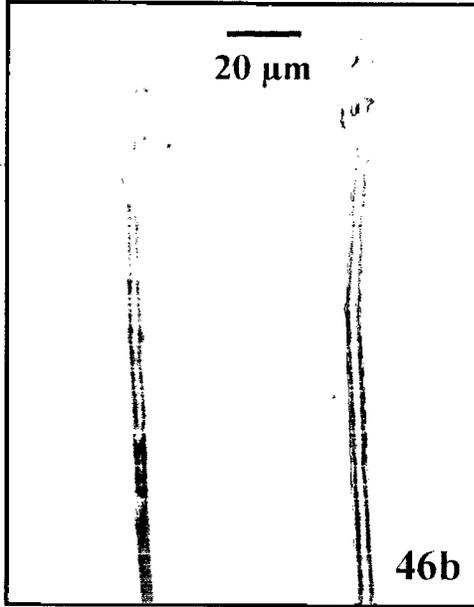
48b- Conidiomata

48c- Conidium

Fig. 46-48



46a



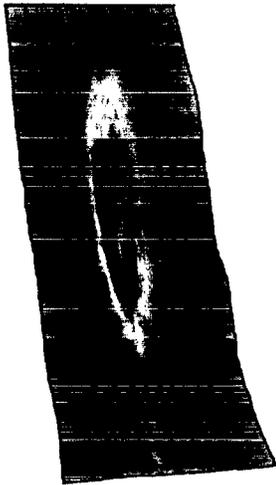
20 μ m

46b

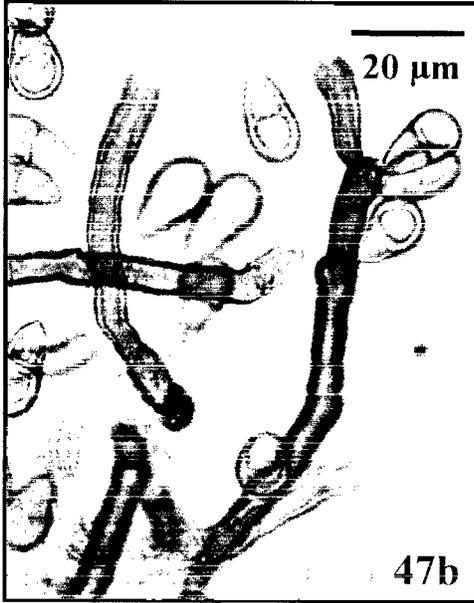


5 μ m

46c

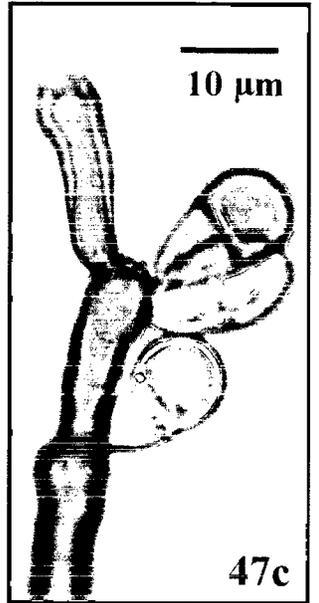


47a



20 μ m

47b

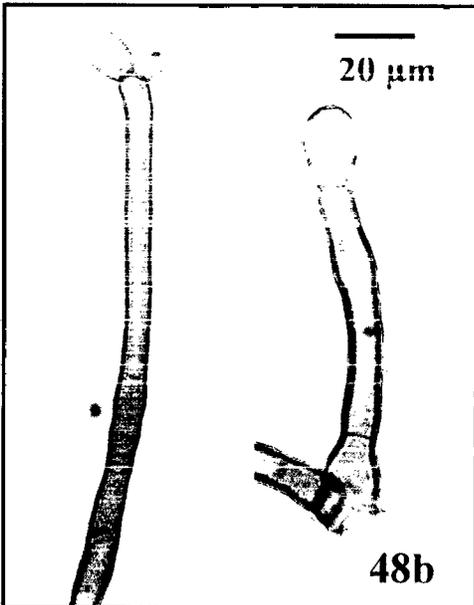


10 μ m

47c

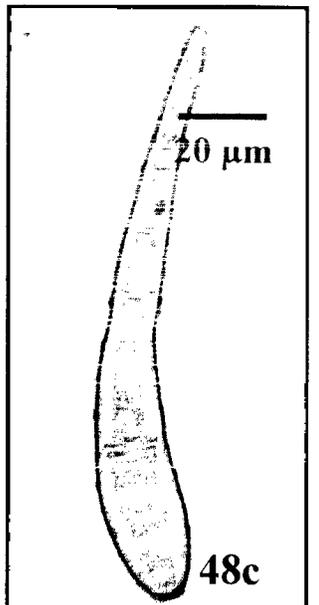


48a



20 μ m

48b



20 μ m

48c

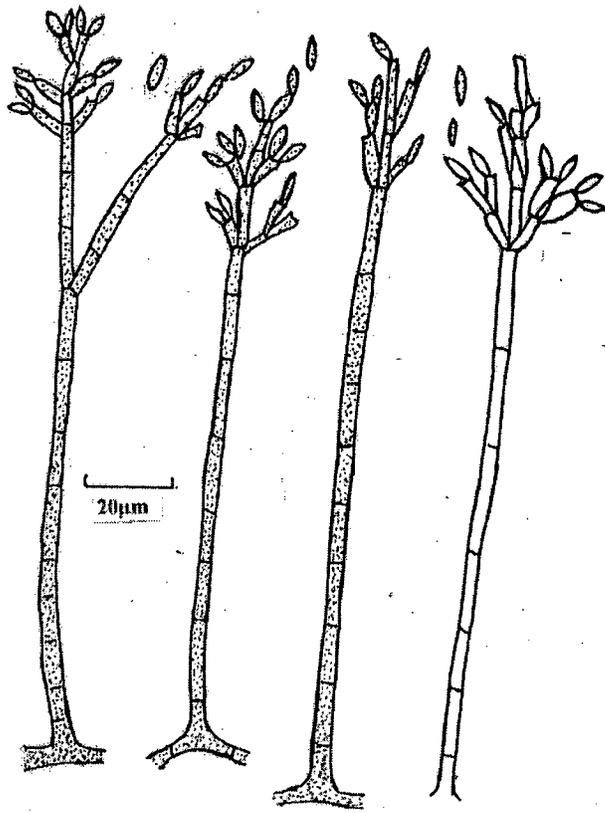


Fig. 46d *Cladosporium semicarpi*

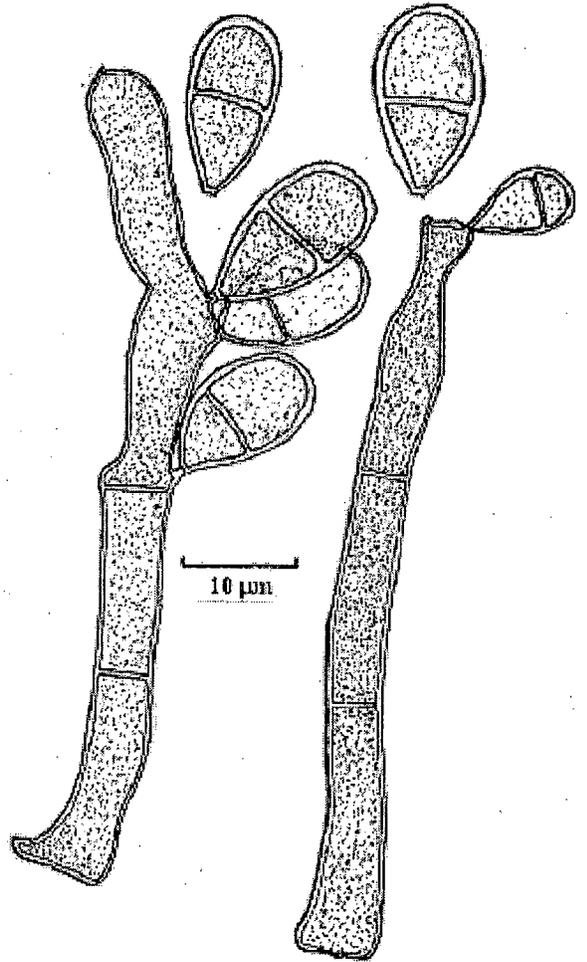


Fig. 47d *Cordana musae*

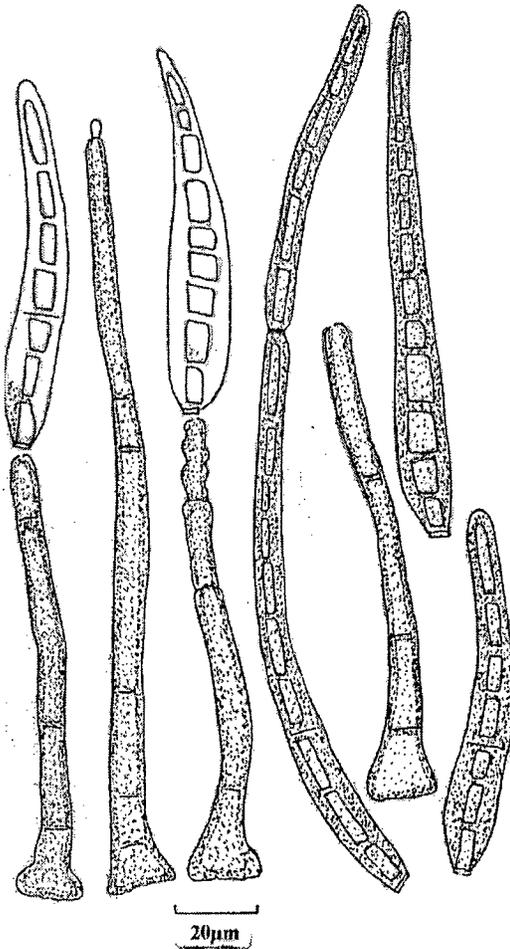


Fig. 48d *Corynespora calicioidea*

Species of *Cordana* are generally associated with decaying plant litter but this particular species, *C. musae* (Zimm.) Hohn. is known to cause leaf spot in *Musa* (Ellis, 1971; 1976). The fungus was isolated from same host from two different places.

48. *Corynespora calicioidea* (Berk. & Broome) M.B. Ellis, 1957. *Mycol. Pap.* 65: 9

(Fig.48a-c; 48d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown with almost black margin, circular to semi-circular, 4-6 mm in diam. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, unbranched, septate, dark brown, thick-walled, sometimes proliferating, 110-195 x 5-9.5 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, light brown, 25-45 x 4-7.5 μm . *Conidia* catenate, simple, acrogenous, smooth, light olivaceous brown, thick-walled, obclavate, rounded at the apex, truncate at the base, pseudoseptate, straight, 60-175 μm long, 8-20 μm wide at the broadest region, 3-5.5 μm at the tip; Juvenile conidia cylindrical, sub-hyaline, sometimes curved.

Specimen examined: On living leaves of *Mackenzia integrifolia* (Dalz.) Bremek. (Lythraceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P86.

A litter fungus, here, recorded as a foliicolous species on the host. This is also a first record from India and Goa region of the Western Ghats.

49. *Corynespora cassiicola* (Berk. & M.A. Curtis) C.T. Wei, 1950. *Mycol. Pap.* 34: 5

(Fig.49a-c; 49d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown with black margin, 2-5 mm in diam., spreading on entire leaf surface. *Colonies* on leaf

spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary or in groups of 2-3, erect, straight to slightly flexuous, smooth, thick walled, dark brown, septate, unbranched, 130-450 x 6-11 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, pale brown, proliferating, 60-120 x 6-9 μm . *Conidia* solitary, simple, smooth, thick-walled, pseudoseptate, olivaceous brown, acrogenous, obclavate, rounded at the apex, truncate at the base, 115-130 x 11-15 μm .

Specimen examined: On living leaves of *Helicteres isora* Linn. (Sterculiaceae), Castle rock, Karnataka, India. 25/07/04, Dr. M.K. Janarthanam, Herb. No. GUBH P133.

C. cassicola is the type species of the genus *Corynespora* (Carmichael et al., 1980). There are about 108 described species. These are generally associated with decaying plant litter but often encountered as foliicolous (Ellis, 1971; 1976).

50. *Corynespora cucurbitaecola* Meenu, Kharwar & Bhartiya. 1998. *Indian Phytopath.* 51(2): 146 (Fig.50a-c; 50d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey to light brown, irregular, 3-5 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous; unbranched, septate, olivaceous brown, thick-walled, smooth, 180-350 x 4.5-7.5 μm . *Conidiogenous cells* monotretic, integrated, terminal, proliferating, cylindrical, 20-120 x 4-6.5 μm . *Conidia* solitary, acrogenous, simple, light olivaceous, smooth, thick-walled, obclavate, pseudoseptate, rounded at the tip, truncate at the base, 50-215 x 9-20 μm .

Specimen examined: On living leaves of *Cucumis sativus* Linn. (Cucurbitaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P74.

This is the first record of the fungus to Goa region of the Western Ghats.

Fig. 49a-c: *Corynespora cassicola*

49a- Leaf spots

49b- Conidiomata

49c- Conidium

Fig. 50a-c: *Corynespora cucurbitaecola*

50a- Leaf spots

50b- Conidiophores with conidia

50c- Conidia

Fig. 51a-c: *Corynespora elaeidicola*

51a- Leaf spots

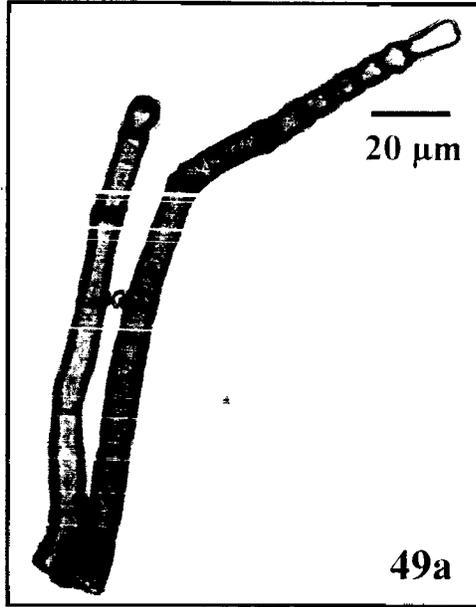
51b- Conidiomata

51c- Conidium

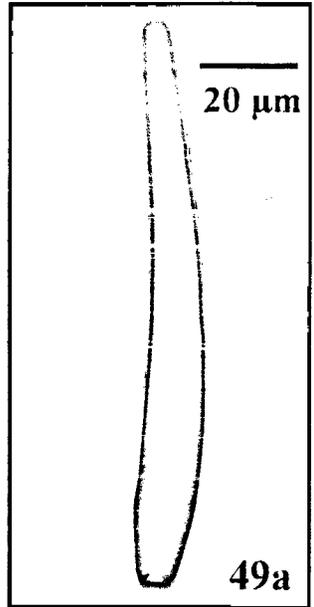
Fig. 49-51



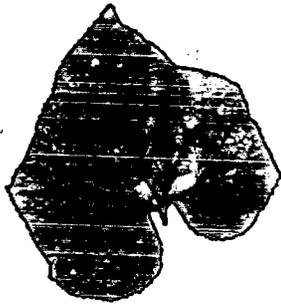
49a



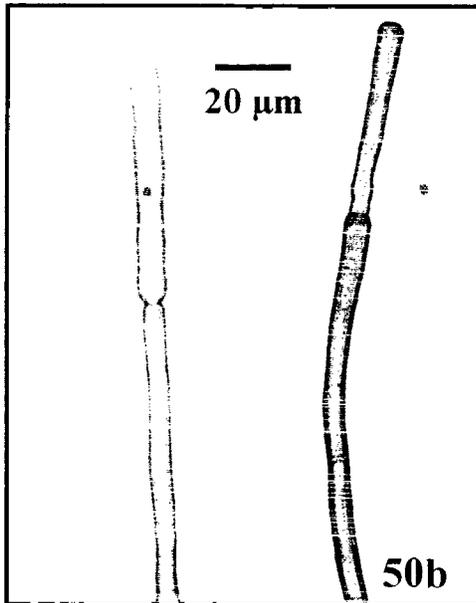
49a



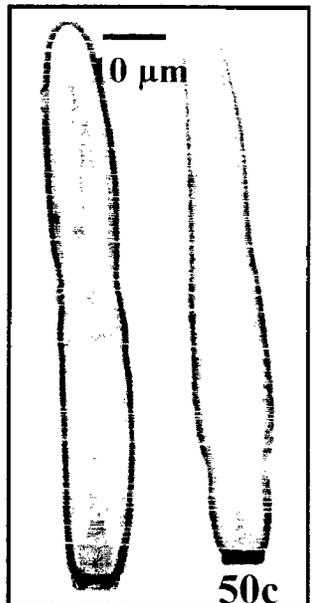
49a



50a



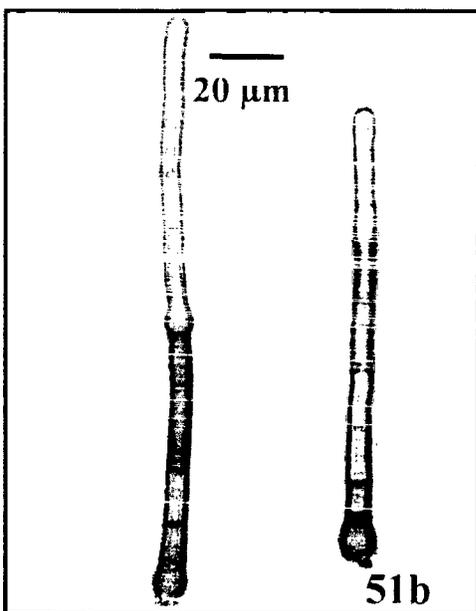
50b



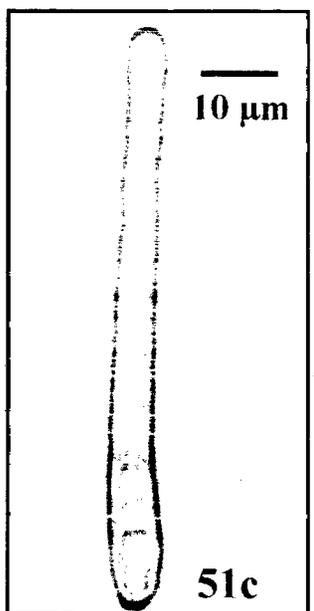
50c



51a



51b



51c

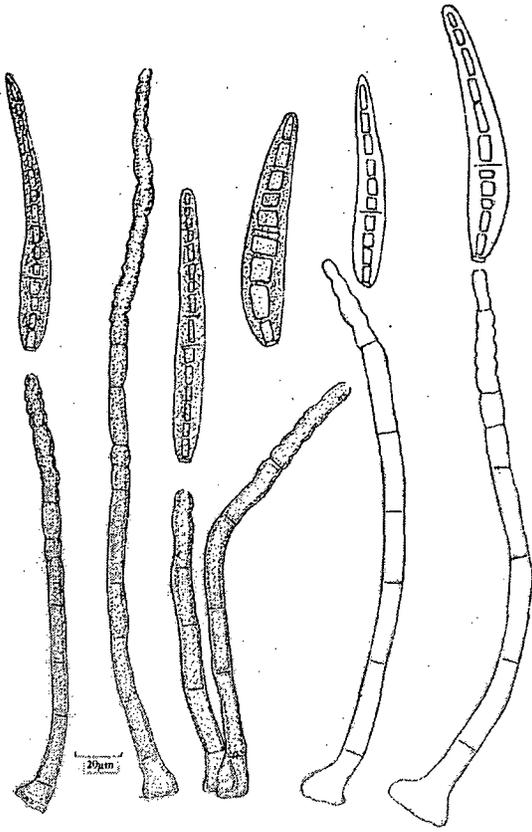


Fig. 49d *Corynespora cassicola*

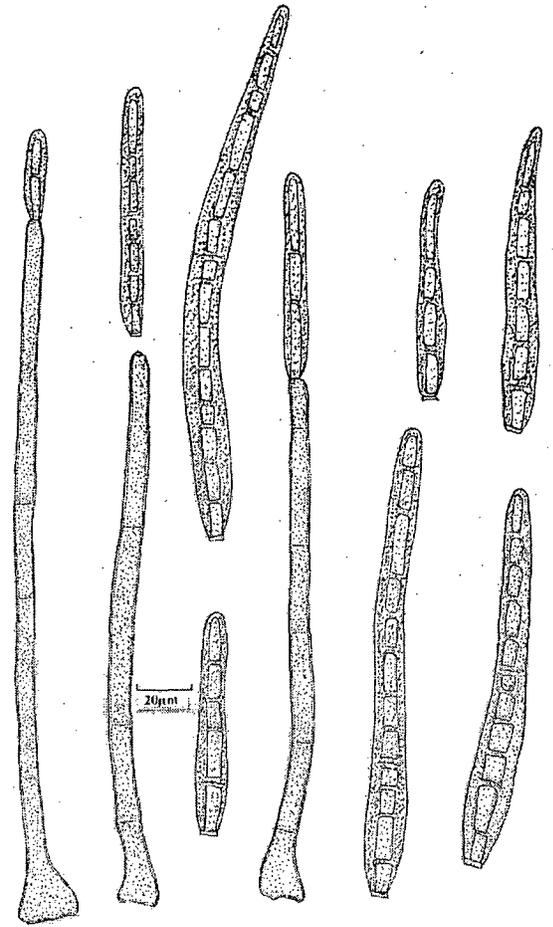


Fig. 50d *Corynespora cucurbitaeicola*

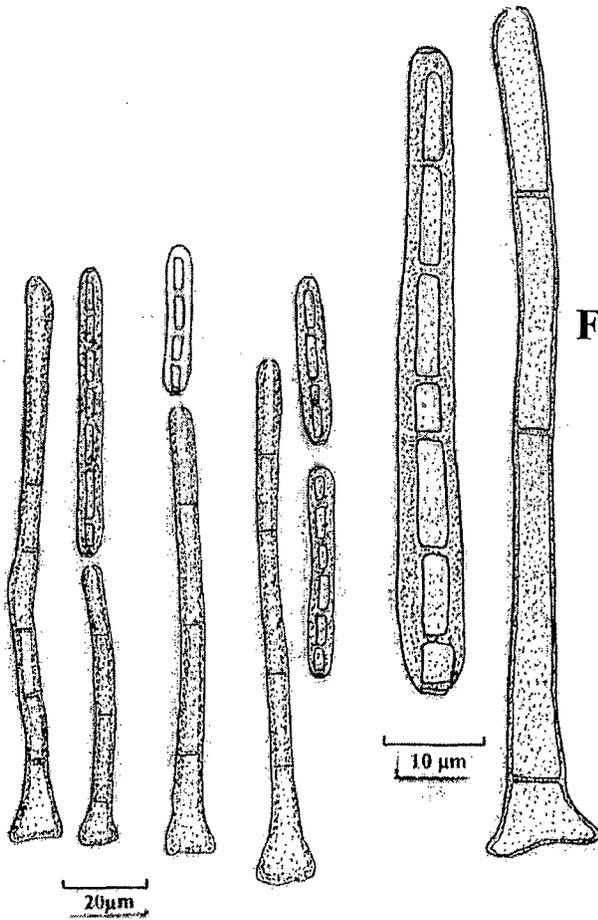


Fig. 51d *Corynespora elaeidicola*

51. *Corynespora elaeidicola* M.B. Ellis, 1960. *Mycol. Pap.* 76: 24 (Fig.51a-c; 51d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white to gray, irregular, 3-4 mm wide. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, branched, septate, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, sometimes branched, septate, smooth, light brown, thick-walled, 80-177 x 4-8 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, cylindrical, 15-28 x 4-7 μm . *Conidia* catenate, acrogenous, light olivaceous, smooth, pseudoseptate, truncate at the base, rounded at the apex, 40-75 x 3-7 μm .

Specimen examined: On living leaves of *Calamus* sp. (Arecaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P100.

A litter fungus known earlier on *Areca catechu*, here recorded as a foliicolous species on *Calamus*. This is also a first record from India and Goa region of the Western Ghats as a foliicolous fungus.

52. *Corynespora nana* Meenu & Kamal, 1998. *Mycol. Res.* 102(3): 345

(Fig.52a-c; 52d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, light brown, 3-6 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary or in loose fascicles of 2-3, unbranched, septate, erect, straight to slightly flexuous, smooth, thick-walled, brown, 110-320 x 5.5-9.5 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, pale brown, 40-55 x 5-8 μm . *Conidia* solitary, smooth, thick-walled,

pseudoseptate, subhyaline, acrogenous. Juvenile conidia sub-hyaline, 10-22 x 10-16 μm .

Specimen examined: On living leaves of *Lantana camara* Linn. (Verbenaceae) GU campus, Taleigao, Goa, 16/06/04, Pratibha, J., Herb. No. GUBH P131.

The report of the fungus is a first record to Goa region of the Western Ghats.

53. *Corynespora ghatensis* sp. nov.

(Fig.53a-c; 53d)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, irregular. *Colonies* on leaf spots effuse, light brown, velvety. *Mycelium* immersed. *Stroma* none, *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, dark brown, smooth, thick-walled, septate, dichotomously branched, rarely unbranched, 110-195 x 6-9 μm . *Conidiogenous cells* monotretic, terminal, determinate, integrated, cylindrical, light olivaceous, 25-33 x 5-8 μm . *Conidia* catenate, sub-hyaline, smooth, pseudoseptate, cylindrical, 40-120 x 5-9 μm .

Holotype: On living leaves of *Calamus* sp. (Arecaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P201; Culture No. GUFCC No. 4912.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately growing, attaining a diam. of 2.0 cm in 7 days, circular, cottony, white, margin serrated, reverse off-white.

The fungus is unique in that the conidiophores are forked twice into short branches. The conidia are elongate-clavate. None of the so far described species exhibit this combination of features and therefore recognised as a second novelty in the genus from this part of the country.

Fig. 52a-c: *Corynespora ghatensis*

52a- Leaf spots

52b- Conidiomata

52c- Conidia

Fig. 53a-c: *Corynespora linguistri*

53a- Leaf spots

53b- Conidiomata

53c- Conidia

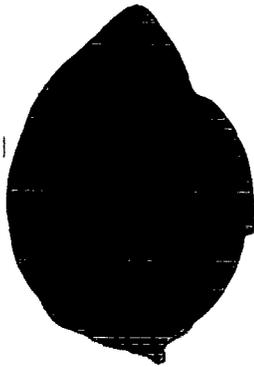
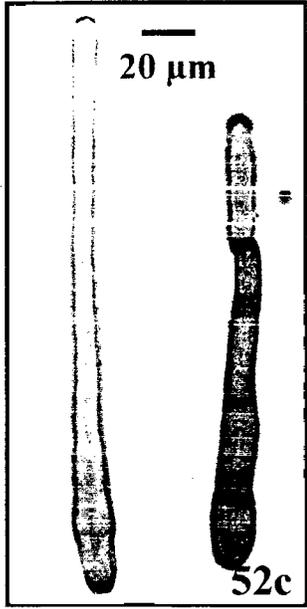
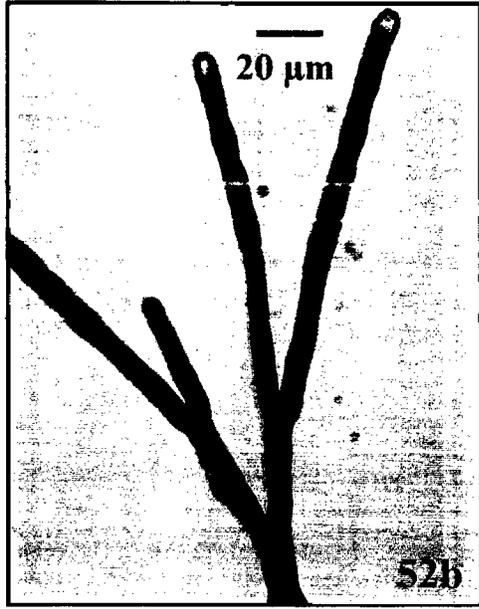
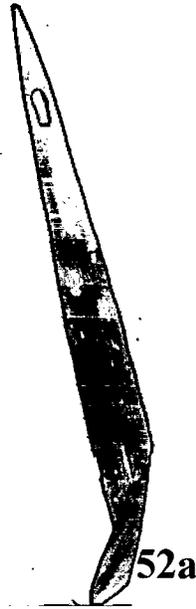
Fig. 54a-c: *Corynespora nana*

54a- Leaf spots

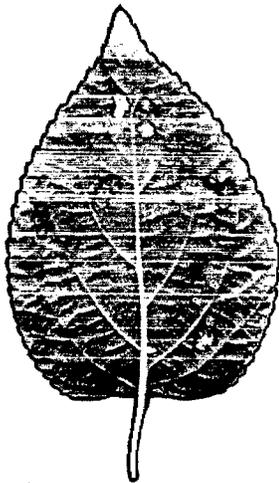
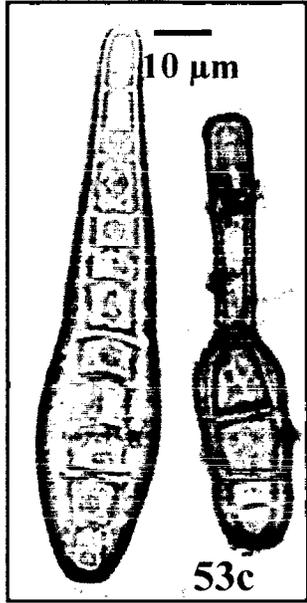
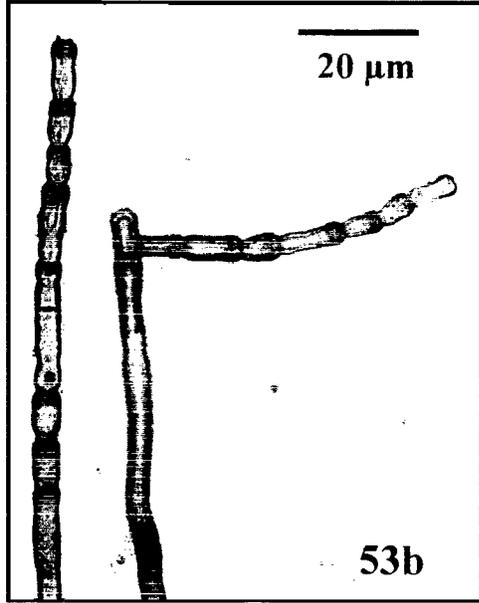
54b- Conidiomata

54c- Conidiophore with conidium

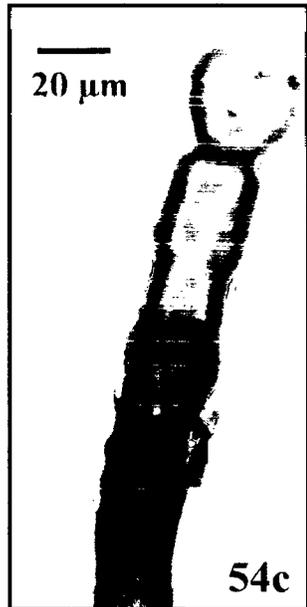
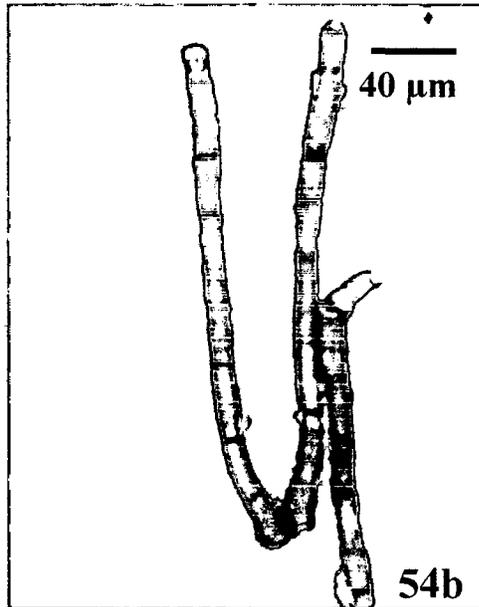
Fig. 52-54



53a



54a



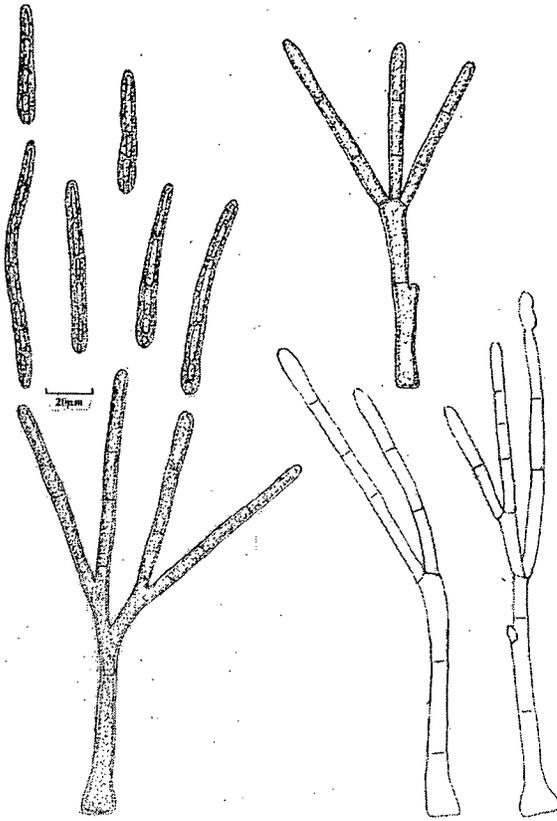


Fig. 52d *Corynespora ghatensis*

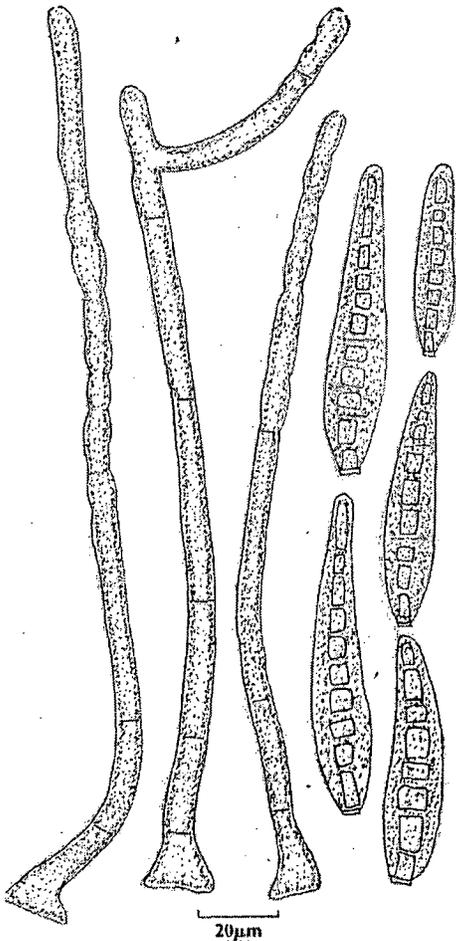


Fig. 53d *Corynespora ligustri*

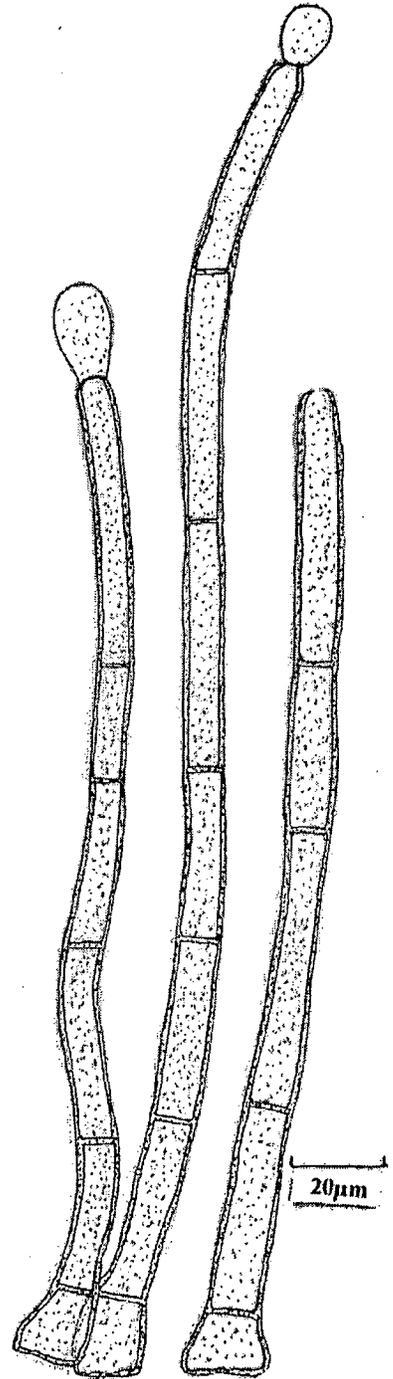


Fig. 54d *Corynespora nana*

54. *Corynespora ligustri* Y.L. Guo, 1984. *Acta Mycol. Sin.* 3(3): 161 (Fig.54a-c; 54d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, initially gray, later turning to dark brown or black, observed on entire leaf surface, 1-3 mm in diam. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary as well as in fascicles of 4-5, straight to slightly flexuous, unbranched to rarely branched, septate, smooth, proliferating, dark brown, 190-335 x 5.5-9 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, cylindrical, 70-100 x 5-7 μm . *Conidia* solitary, simple, dry, acrogenous, light olivaceous, smooth, pseudoseptate, sub-obtuse to rounded at the apex, truncate at the base, 40-150 μm long, 7-23 μm wide at the broadest part, 4.5-6.5 μm wide at the apical region.

Specimen examined: On living leaves of *Jasminum* sp. (Oleaceae), Banastari, Ponda Goa, 15/03/03, Pratibha, J., Herb. No. GUBH P23.

This is the first record of the fungus to Goa region of the Western Ghats. The fungus has earlier been recorded as foliicolous. (Sharma and Srivatsava, 2004).

55. *Corynespora yanensis* sp. nov. (Fig.55a-c; 55d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey, circular to irregular, 3-6 mm wide. *Colonies* on leaf spots effuse, light brown. *Mycelium* immersed. *Stroma* none, *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, brown, septate, unbranched to dichotomously branched at the upper region, dark brown at the basal cells, 200-510 x 8-12.5 μm . *Conidiogenous cells* monotretic, terminal, determinate, integrated, cylindrical, proliferating, light olivaceous, 60-120 x 8-10 μm . *Conidia* catenate, olivaceous brown, obclavate, smooth, pseudoseptate, rounded at the apex, truncate at

the base, 90-130 x 17-25 μm . *Juvenile* conidia sub-hyaline, aseptate, ellipsoidal, 30-4 x 13-18 μm .

Holotype: On living leaves of *Vitex* sp. (Verbenaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P200; Culture No. GUFCC No. 4911.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 8.0 cm in 7 days, circular, dark brown, cottony, margin serrated, reverse black.

The fungus is unique in that the conidiophores are symmetrically forked in the above half and often proliferates. The conidia also proliferate. None of the so far described species exhibit this combination of features and therefore recognised as a novelty in the genus.

56. *Corynespora* sp. 1

(Fig.56a-c; 56d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular in the form of concentric rings, sometimes irregular, grey, 4-6 mm in diam. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary as well as in group of 5-7, erect, straight to flexuous, mostly unbranched, rarely branched, septate, smooth, dark brown, thick-walled, 115.5-192.5 x 5.5-9.5 μm . *Conidiogenous cells* monotretic, terminal, determinate, integrated, proliferating, cylindrical, 18-65 x 5.5-8.5 μm . *Conidia* solitary, simple, acrogenous, light brown, smooth, pseudoseptate, rounded to sub-obtuse at the apex, truncate at the base, 35.5- 77.5 x 7.5-18.5 μm , *Juvenile* conidia hyaline to light olivaceous, aseptate.

Specimen examined: On living leaves of *Vitex nigundo* L. (Verbenaceae), St. Estevam, Tiswadi, Goa, 19-07-03, Pratibha, J., Herb. No. GUBH P52.

Fig. 55a-c: *Corynespora yanensis*

55a- Leaf spots

55b- Conidiomata

55c- Conidia

Fig. 56a-c: *Corynespora* sp. 1

56a- Leaf spots

56b- Conidiomata

56c- Conidium

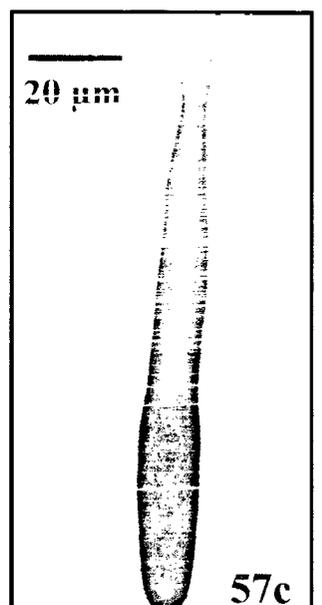
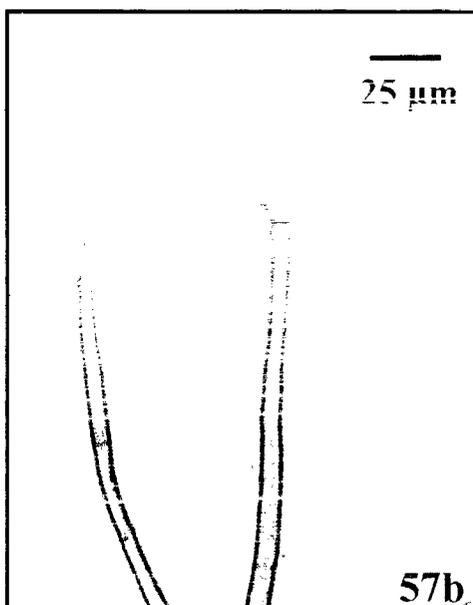
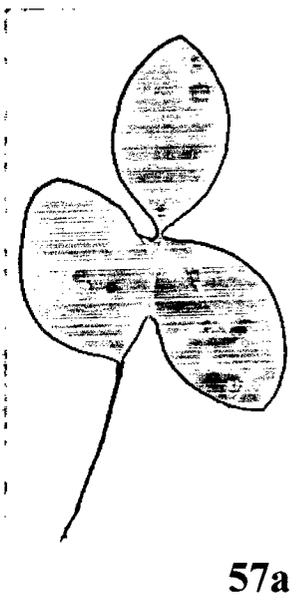
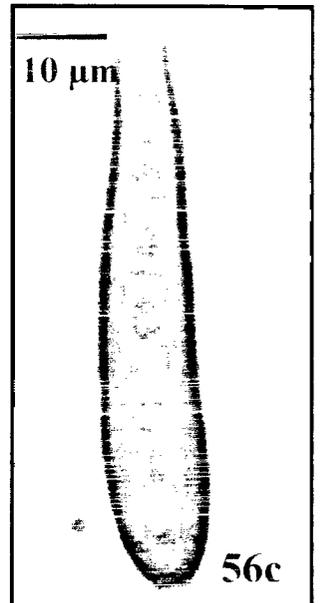
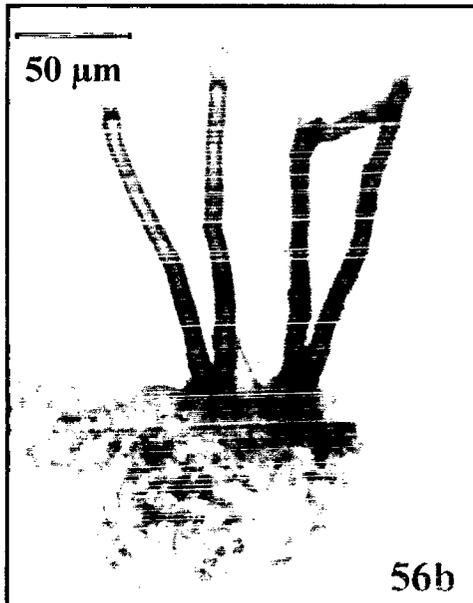
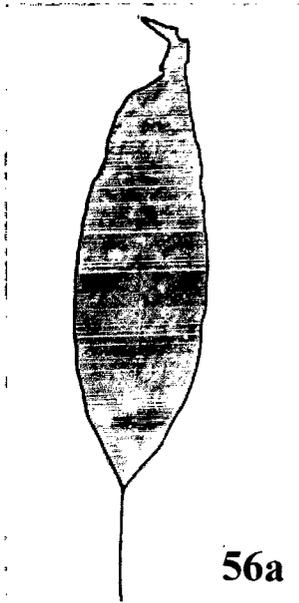
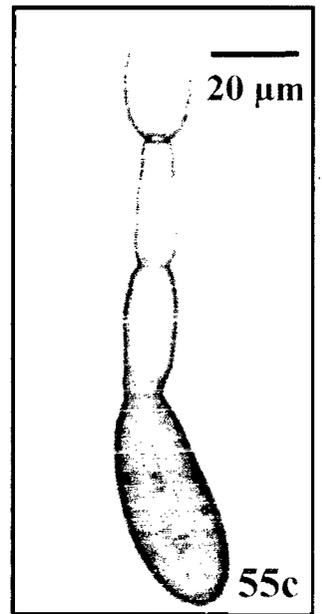
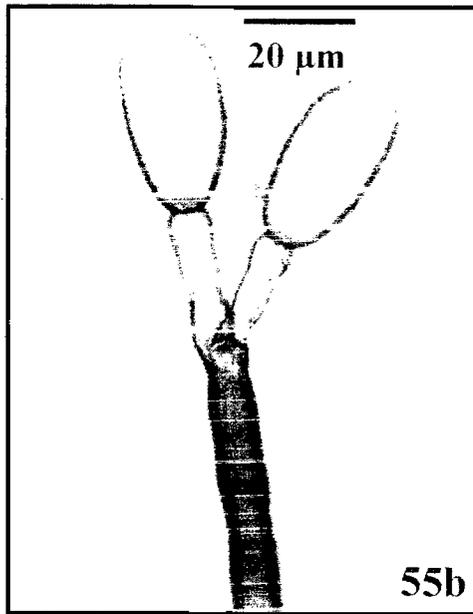
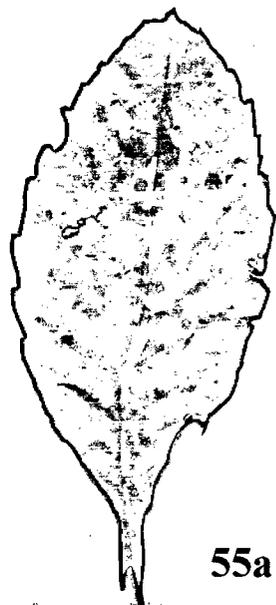
Fig. 57a-c: *Corynespora* sp. 2

57a- Leaf spots

57b- Conidiomata

57c- Conidium

Fig. 55-57



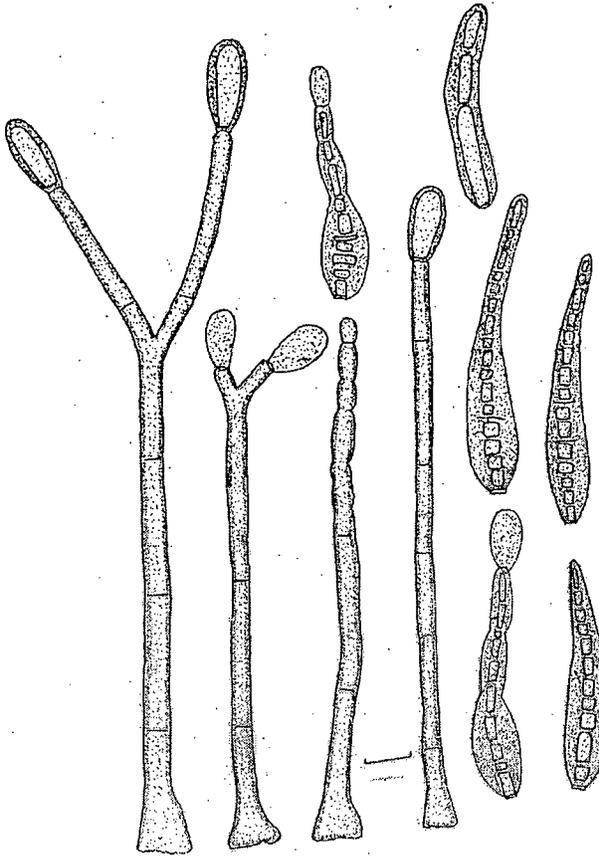


Fig. 55d *Corynespora yanensis*

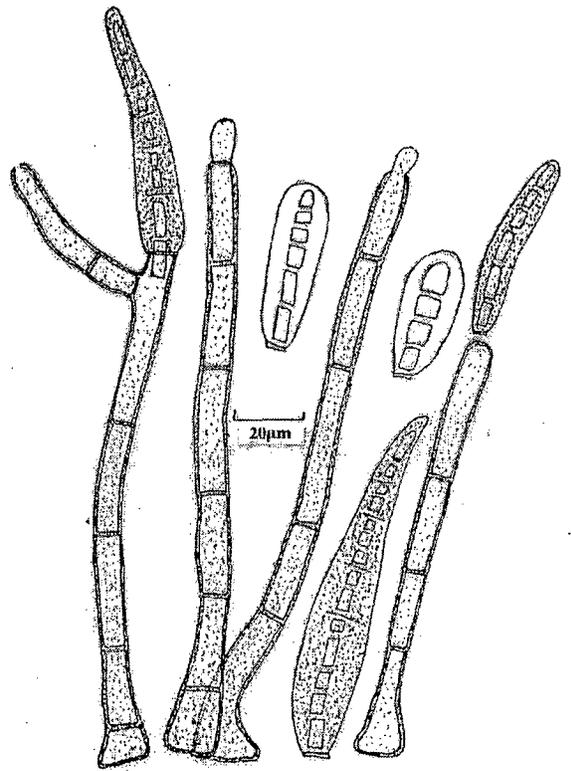


Fig. 56d *Corynespora* sp.1

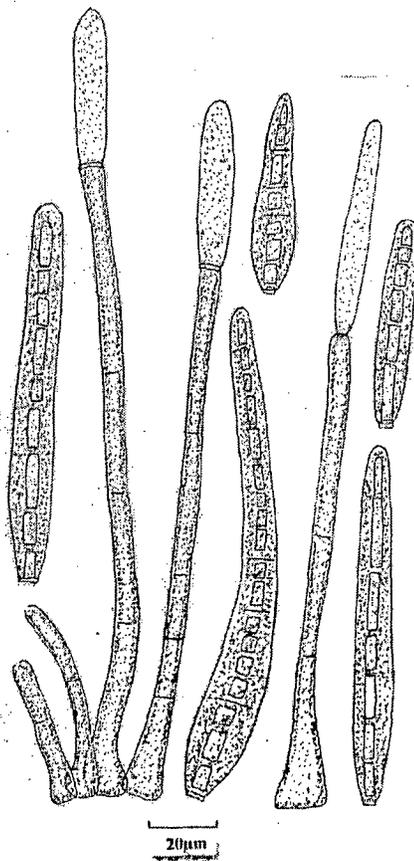


Fig. 57d *Corynespora* sp.2

57. *Corynespora* sp. 2**(Fig.57a-c; 57d)**

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to semi-circular, dark brown to black, spreading throughout the leaf surface, 6-12 mm in diam. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary as well as in small to moderately large dense fascicles, erect, straight to flexuous, unbranched, 2-8 septate, smooth, light brown, 55-570 x 4-9 μm . *Conidiogenous cells* monotretic, integrated, terminal, determinate, cylindrical, 80-115 x 5-8 μm . *Conidia* solitary, light brown, smooth, pseudoseptate, rounded at the apex, truncate at the base, 25-67 x 2-3.5 μm , Juvenile conidia hyaline to light olivaceous, aseptate.

Specimen examined: On living leaves of *Carissa carandas* Linn. (Apocynaceae), Banastari, Ponda Goa, 19/02/03, Herb. No. GUBH P17; Hankani, Karnataka, India, 26/10/04, Pratibha, J., Herb. No. GUBH P17.

58. *Corynespora* sp. 3**(Fig.58a-c; 58d)**

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, irregular, sometimes circular with concentric rings, 2-4 mm in diam. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary as well as in groups of 5-7, erect, straight to slightly flexuous, unbranched, septate, smooth, dark brown, thick walled, 200-365 x 5.5-9 μm . *Conidiogenous cells* monotretic, terminal, determinate, integrated, cylindrical, 40-55 x 5-7 μm . *Conidia* solitary, simple, acrogenous, light brown, smooth, pseudoseptate, obclavate, rounded at the apex, truncate at the base, 120-200 x 9-16 μm .

Specimen examined: On living leaves of *Allamanda cathartica* Linn. (Apocynaceae), Campal, Panjim Goa, 15-08-03, Herb. No. GUBH P63; Calem, Sanguem Goa, 22/06/04, Herb. No. GUBH P63; University Campus, Taleigao Goa, 15/09/04, Pratibha, J., Herb. No. GUBH P63.

59. *Corynespora* sp. 4

(Fig.59a-c; 59d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of smooth, thin walled, hyaline, branched, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight, unbranched, septate, smooth, light brown, thick-walled, 115-155 x 4-7 μm . *Conidiogenous cells* polytretic, terminal, determinate, integrated, 65-80 x 4-6.5 μm , 9.5-13 μm at the swollen apex. *Conidia* solitary, simple, light olivaceous, smooth, pseudoseptate, obclavate, rounded at the apex, truncate at the base, 25-130 x 13.5-17.5 μm .

Specimen examined: On living leaves of *Cucumis trigonus* Roxb. (Cucurbitaceae), Goa University Campus, Taleigao Goa, 28-08-03, Pratibha, J., Herb. No. GUBH P66.

60. *Corynespora* sp. 5

(Fig.60a-c; 60d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, tiny, grey to light brown, 1-3 mm in diam., spreading on entire leaf surface, central part later collapses leaving a shot hole. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, thick walled, dark brown, septate, unbranched, 90-130 x 6-9 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, pale brown, 20-27 x 5-7 μm . *Conidia* solitary, simple, smooth, thick-walled, pseudoseptate, olivaceous brown, acrogenous, obclavate, rounded at the apex, truncate at the base, 60-120 x 8-17 μm . Juvenile conidia hyaline, aseptate, 25-35 x 7-9.5 μm .

Specimen examined: On living leaves of *Momordica charantia* Linn. (Cucurbitaceae), Calem, Sanguem, Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P133.

Fig. 58a-c: *Corynespora* sp. 3

58a- Leaf spots

58b- Conidiomata

58c- Conidia

Fig. 59a-c: *Corynespora* sp. 4

59a- Leaf spots

59b- Conidiomata

59c- Conidia

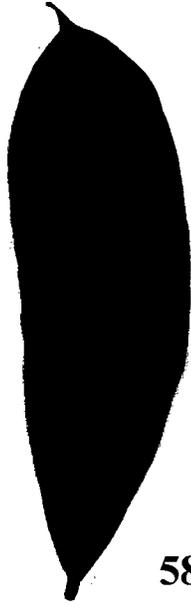
Fig. 60a-c: *Corynespora* sp. 5

60a- Leaf spots

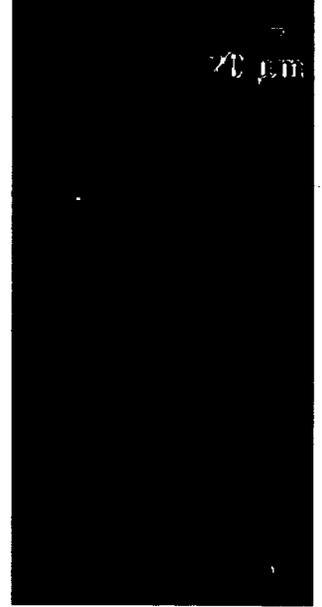
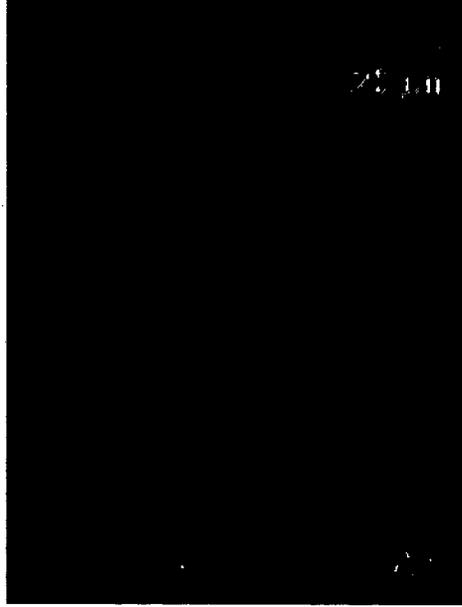
60b- Conidiomata

60c- Conidium

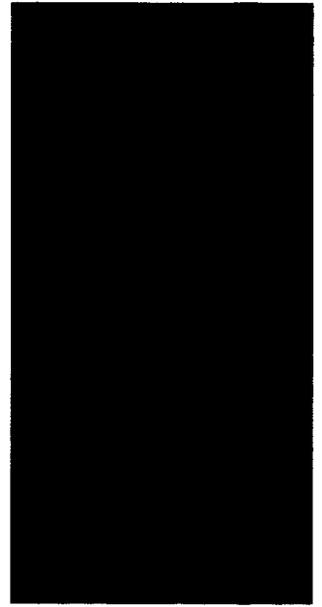
Fig. 58-60



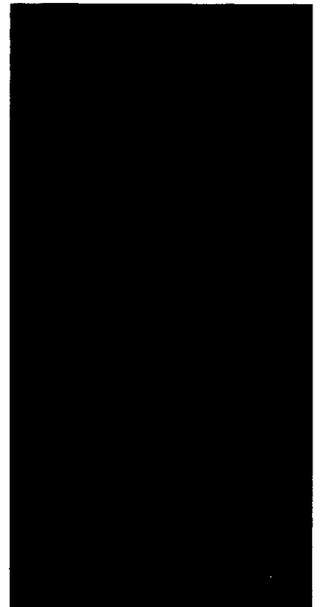
58a



59a



60a



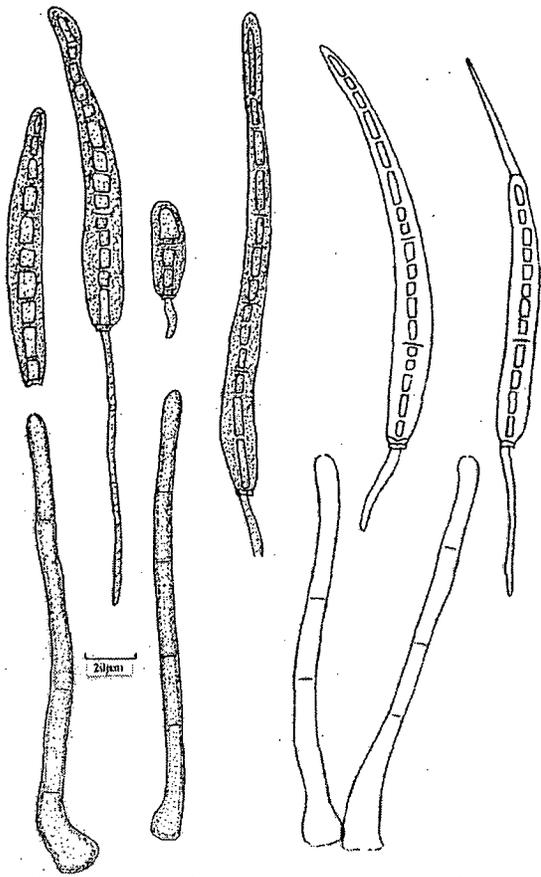


Fig. 58d *Corynespora* sp.3

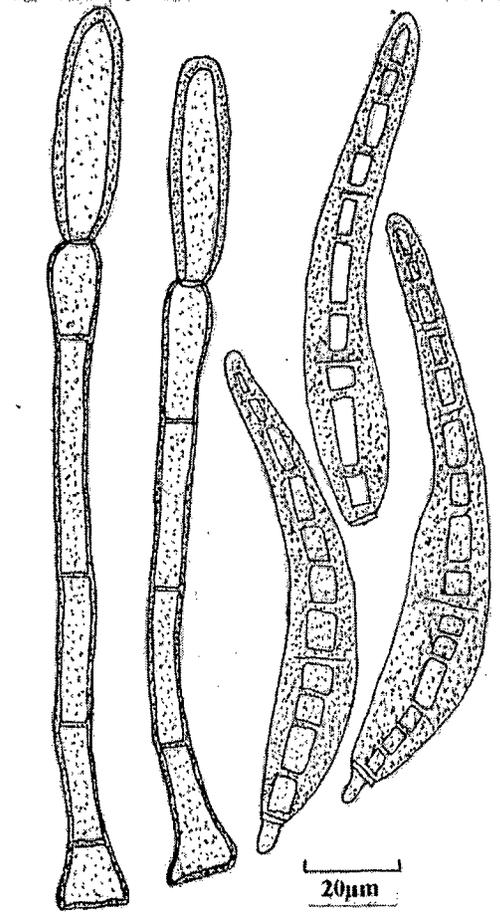


Fig. 59d *Corynespora* sp.4

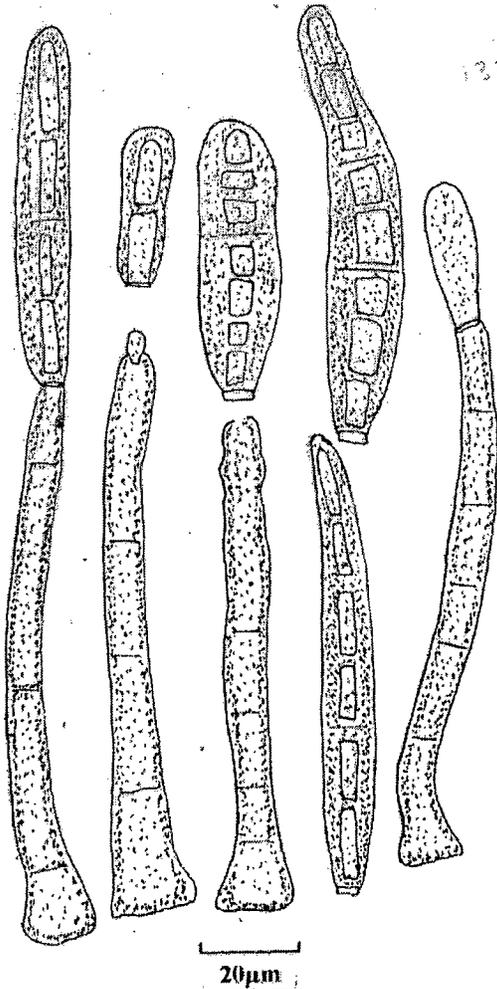


Fig. 60d *Corynespora* sp.5

The above 5 taxa of *Corynespora* were not identified down to species level at this stage due to want of adequate literature. However, it is clear that they are distinct from each other in their conidiophore and conidium morphology and dimensions and does not match either with hitherto described species in the genus.

61. *Curvularia ovoidea* (Hiroe & N. Watan.) Munt.-Cvetk., 1957. *Rev. agron. Noroeste Argent.* 2: 322 (Fig.61a-c; 61d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, grayish brown, 1-2 cm in diam. Spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* partly immersed, partly superficial, composed of light brown, thin walled, branched, septate, 2-3 μm wide hyphae. *Sroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, unbranched, septate, brown, 80-250 x 3-5 μm . *Conidiogenous cells* polytretic, integrated, terminal, cicatrized, 23-45 x 3-6 μm . *Conidia* solitary, simple, 3-septate, pale brown, smooth, 14-20 x 10-15 μm .

Specimen examined: On living leaves of *Ficus benghalensis* Linn. (Moraceae), University campus, Taleigao Goa, 25/01/03, Pratibha, J., Herb. No. GUBH P14; Culture No. GUFCC No. 4913.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 6.9 cm in 7 days, circular, cottony, light brown, margin wavy, reverse brown.

62. *Curvularia trifolii* (Kauffman) Boedijn, 1933. *Bulletin du Jardin Botanique de Buitenzorg*, 3 Série 13(1): 128 (Fig.62a-c; 62d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown, 2-7 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth,

septate, branched, hyaline, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, thick walled, brown, septate, unbranched, 100-300 x 5-7 μm . *Conidiogenous cells* polytretic, terminal as well as intercalary, integrated, determinate, sympodial, cicatrized, proliferating, 15-30 x 5-6 μm . *Conidia* solitary, simple, smooth, thick walled, brown, acropleurogenous, 3-4-septate, slightly curved, 28-35 x 10-17 μm .

Specimen examined: On living leaves of *Saccharum officinarum* Linn. (Poaceae), Paryem, Sattari Goa, 02/07/04, Pratibha, J. Herb. No. GUBH P147.

The above 2 species of the genus *Curvularia* Boedijn, *C. ovoidea* and *C. trifolii*, have been reported here for the first time as 'foliicolous'. Almost all species of *Curvularia* are known to be litter-inhabiting fungi (Ellis, 1971; 1976). Some of them have also been reported as endophytes (Bills, 1996; Kumaresan and Suryanarayanan, 2001).

63. *Cylindrocladium* sp.

(Fig.63a-c; 63d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown to black, 4-6 mm wide, only one or two spots were observed on few leaves of the tree. *Colonies* on leaf spots effuse, grey. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, branched, smooth, hyaline, terminating in a loosely branched fertile head and single, sterile, erect, smooth, hyaline stipe terminating into an ellipsoidal vesicle, 80-215 x 3-5 μm . *Conidiogenous cells* monophialidic discrete, terminal, cylindrical, hyaline, 17-27 μm long.

Specimen examined: On living leaves of *Helicteres isora* Linn. (Sterculiaceae), Colem, Sanguem, Goa, India. 26/08/04, Pratibha, J., Herb. No. GUBH P167.

Fig. 61a-c: *Curvularia ovoidea*

61a- Leaf spots

61b- Conidiomata

61c- Conidia

Fig. 62a-c: *Curvularia trifolii*

62a- Leaf spots

62b- Conidiomata

62c- Conidia

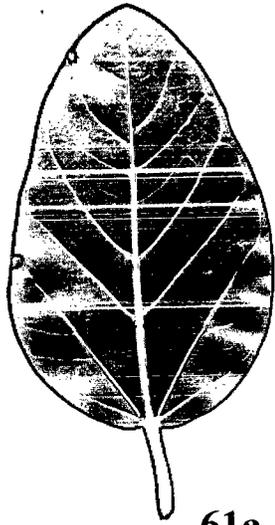
Fig. 63a-c: *Cylindrocladium* sp.

63a- Leaf spots

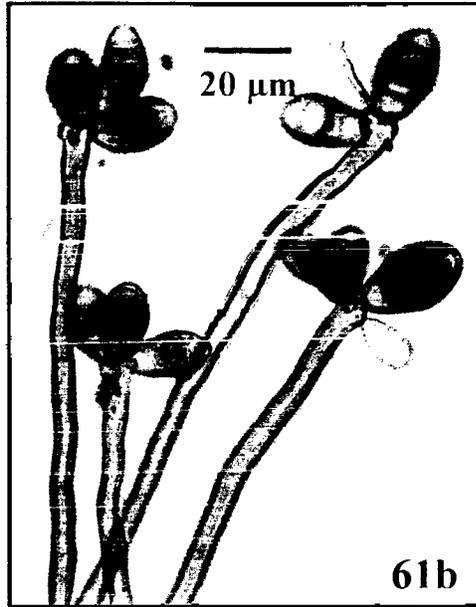
63b- Conidiomata

63c- Conidiophore

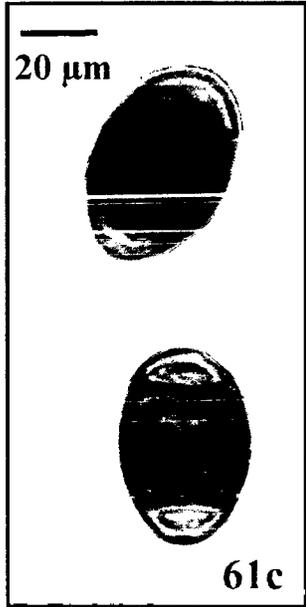
Fig. 61-63



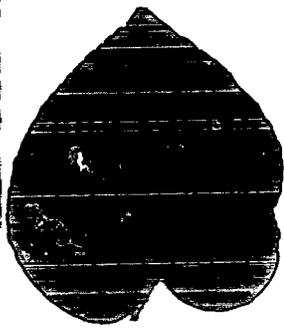
61a



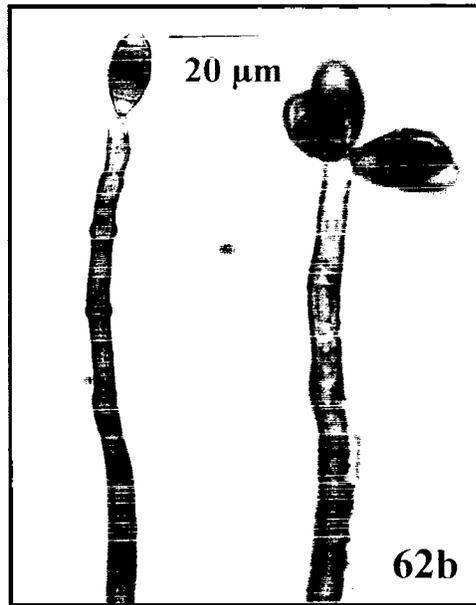
61b



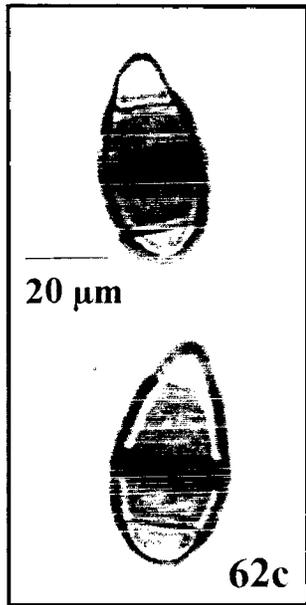
61c



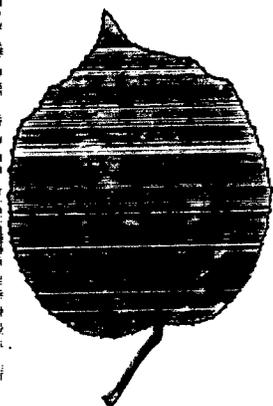
62a



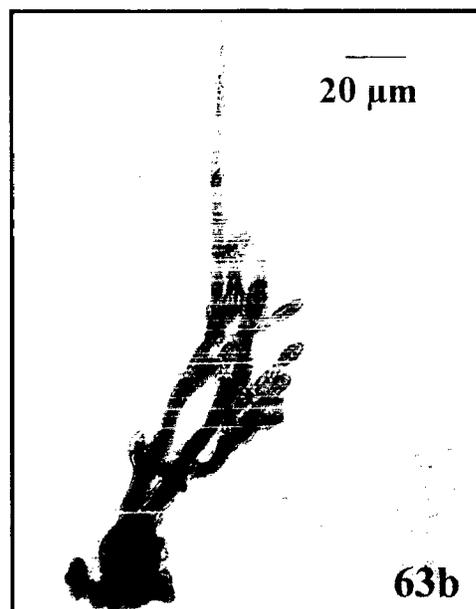
62b



62c



63a



63b



63c

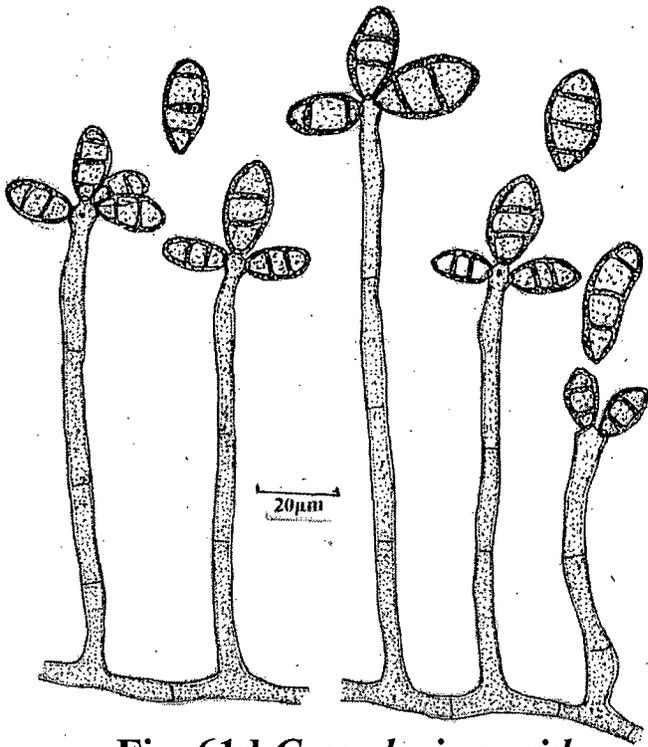


Fig. 61d *Curvularia ovoidea*

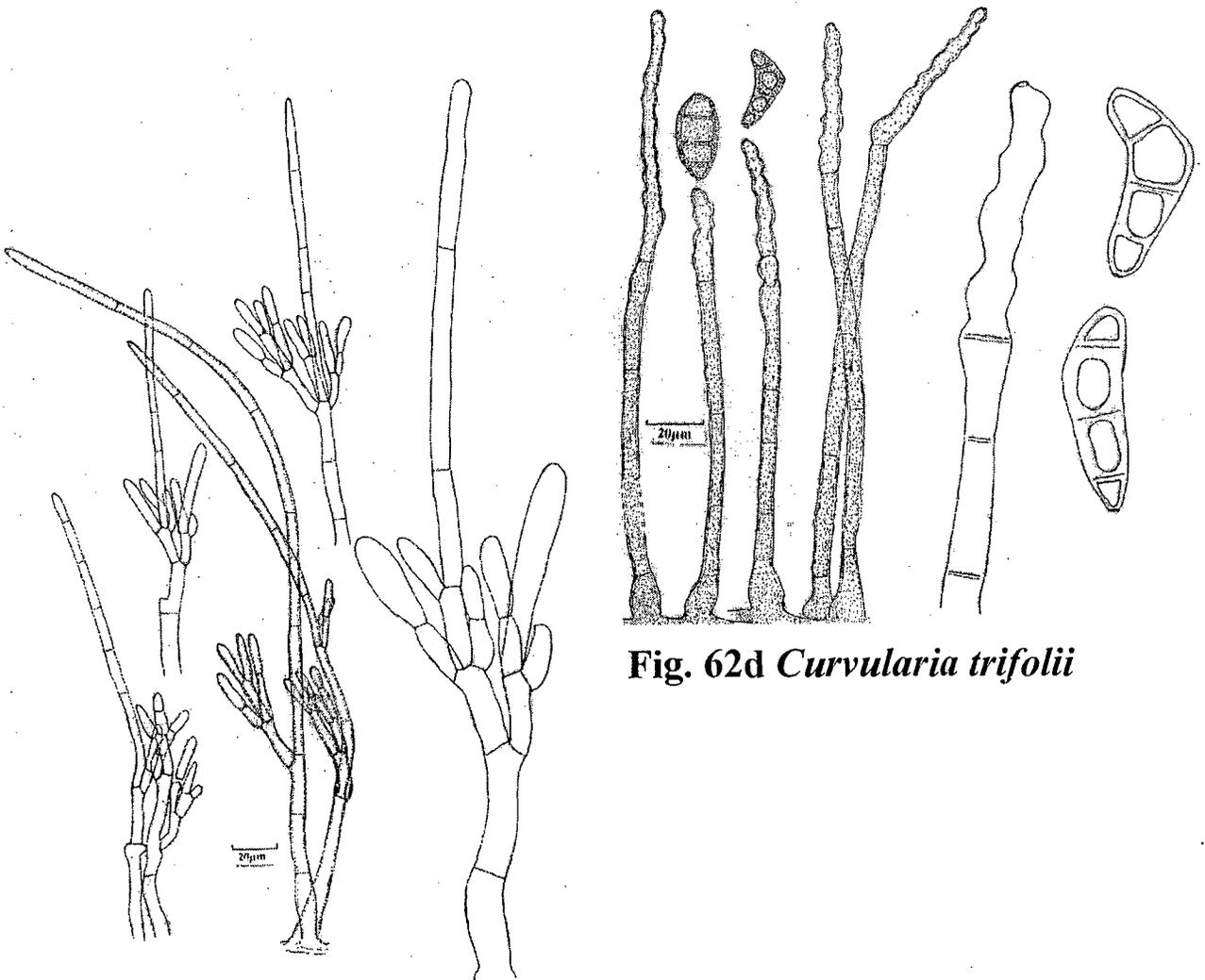


Fig. 62d *Curvularia trifolii*

Fig. 63d *Cylindrocladium* sp.

The so far described species of *Cylindrocladium* are either soil or litter inhabitants. This is the first record of a taxon in the genus as 'foliicolous' from anywhere in the world.

64. *Dactylella ellipsospora* (Preuss) Grove, 1886. In Saccardo, *Syll. fung.* (Abellini) 4: 194 (Fig.64a-c; 64d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, initially light brown with dark brown margin, later turning black, mostly observed at the tip of the leaf. *Colonies* on leaf spots effuse, white, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thin-walled, hyaline to sub-hyaline, 170-270 x 2-3 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate. *Conidia* solitary, simple, dry, hyaline, 4-septate, rounded at both the ends, 40-55 μm long, 14-22 μm wide at the broadest part.

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Valpoi, Sattari Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P41.

Around 90 species of *Dactylella* have so far been described. All these are known to be litter-inhabiting fungi (Ellis, 1971, 1976; Matsushima, 1971, 1975). The above document is first record of the fungus as foliicolous.

65. *Deightoniella torulosa* (Syd.) M.B. Ellis, *Mycol. Pap.* 66: 7 (1957)

(Fig.65a-c; 65d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey, forming irregular large patches with brown margin. *Colonies* on leaf spots effuse, dark brown to black, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight, unbranched, septate, smooth, brown, thick walled, 50-140 x 6-10 μm . *Conidiogenous cells* monoblastic, integrated,

terminal, determinate, percurrent, 25-60 x 5.5-9.5 μm . *Conidia* solitary, simple, acrogenous, pale brown, smooth, 2-3 septate, obclavate, rounded at the apex, truncate at the base, 40-65 long, 12-27 μm wide at the broadest part.

Specimen examined: On living leaves of *Musa paradisiaca* Linn. (Musaceae), St. Estevam, Tiswadi, Goa, 19/07/03, Pratibha, J., Herb. No. GUBH P53.

Species of *Deightoniella* are generally associated with decaying plant litter but *D. torulosa* has been known to cause leaf spots in *Musa* in (Ellis, 1971; 1976) several parts of tropical countries. This is the first record of the fungus from Goa region of the Western Ghats.

66. *Denticularia modesta* (Syd.) Deighton, 1972. *Trans. Br. mycol. Soc.* 59(3): 422

(Fig.66a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, irregular, sometimes 3-7 mm wide. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large dense fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, olivaceous brown, 35-70 x 3-4.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, determinate, sympodial, denticulate; denticles short, sub-cylindrical. *Conidia* catenate, dry, simple, acropleurogenous, pale olivaceous brown, smooth, 0-1-septate, 8-18 x 3-4.5 μm .

Specimen examined: On living leaves of *Anacardium occidentale* Linn. (Anacardiaceae), Mashem, Cancona Goa, 13/02/04, Pratibha, J., Herb. No. GUBH P223.

Five species of *Denticularia* so far described are truly foliicolous (Ellis, 1976). *D. modesta* is recorded for the first time from Goa region of the Western Ghats.

Fig. 64a-c: *Dactylella ellipospora*

64a- Leaf spots

64b- Conidiomata

64c- Conidium

Fig. 65a-c: *Deightoniella torulosa*

65a- Leaf spots

65b- Conidiomata

65c- Conidium

Fig. 66a-c: *Denticularia modesta*

66a- Leaf spots

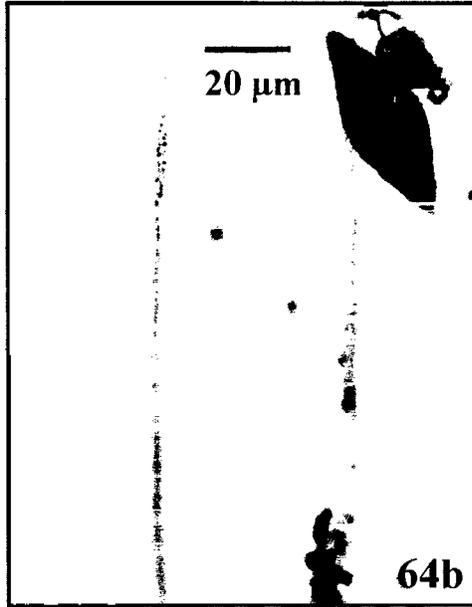
66b- Conidiomata

66c- Conidia

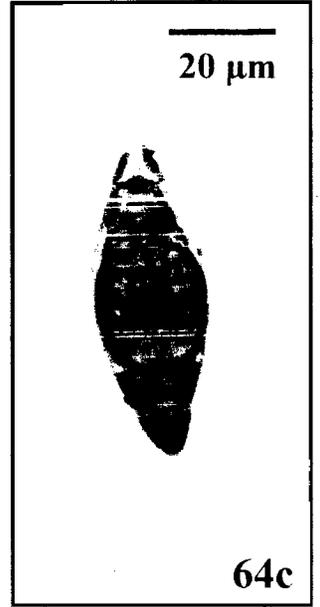
Fig. 64-66



64a



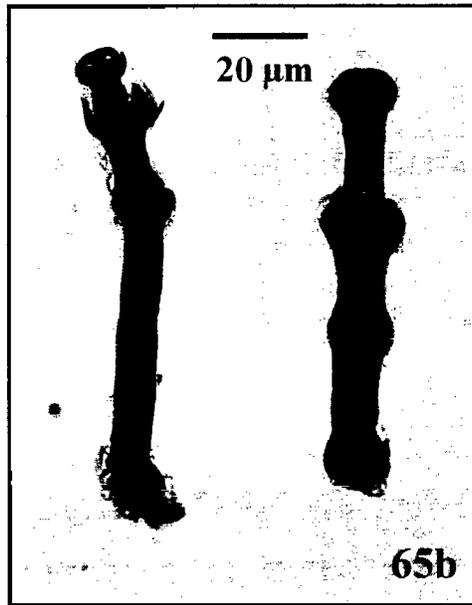
64b



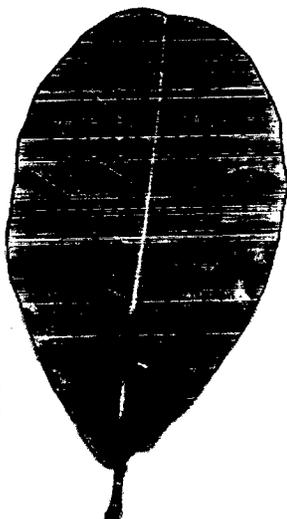
64c



65a



65b



66a



66b



66c

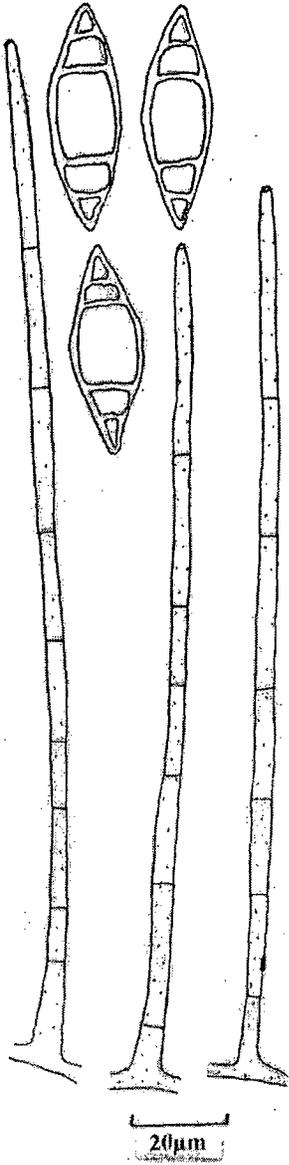


Fig. 64d *Dactylella ellipospora*

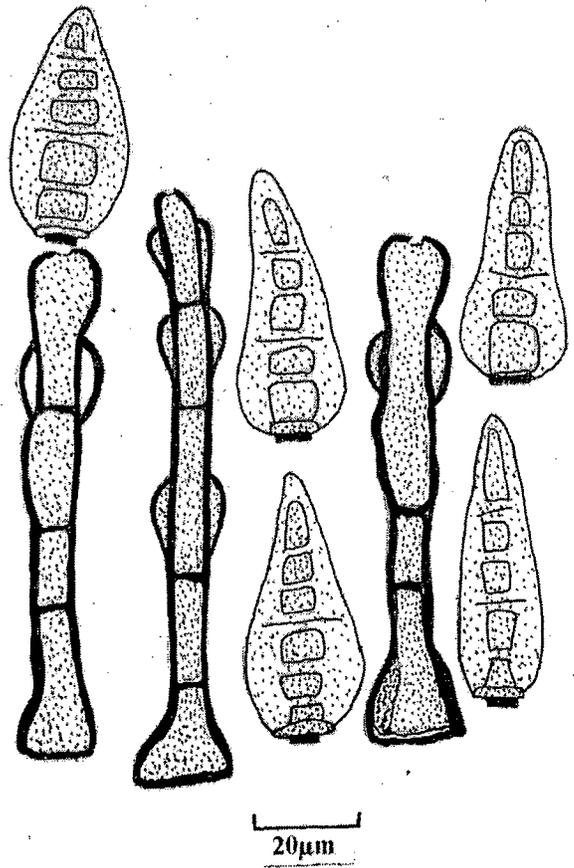


Fig. 65d *Deightoniella torulosa*

67. *Diplococcium spicatum* Grove, 1885. *J. Bot.*, London **23: 167 (Fig.67a-c; 67d)**

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, sometimes circular, light brown in the centre with dark brown margin, 3-5 mm wide, later spreading on entire leaf surface, most of the leaves of the plant showed the infection. *Colonies* on leaf spots effuse, dark brown, velvety. *Mycelium* partly immersed, partly superficial, composed of branched, septate, hyaline, smooth, 2-4 µm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, dark brown, thick-walled, 60-110 x 3-5 µm. *Conidiogenous cells* polytretic, terminal as well as intercalary, integrated, determinate, light brown, 17-36 x 3-5 µm. *Conidia* catenate, light brown, smooth, 1-septate, rounded at both ends, 6-11 x 3-4.5 µm.

Specimen examined: On living leaves of *Areca catechu* Linn. (Arecaceae), Banastari, Ponda Goa, 19/11/03, Pratibha, J., Herb. No. GUBH P116.

The genus *Diplococcium* Grove is typified by *D. spicatum* Grove. So far about 30 species are known. All are true litter inhabiting fungi (Ellis, 1971; 1976). This is however the first record of *D. spicatum* as foliicolous.

68. *Doratomyces nanus* (Ehrenb.) F.J. Morton & G. Sm., *Mycol. Pap.* **86: 80 (1963)**

(Fig.68a-c; 68d)

Fungus Hyphomycete. *Leaf spots* amphigenous, numerous, grey with dark brown margin, irregular. *Colonies* on leaf spots effuse, light green, powdery. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* synnematous, erect, straight to slightly flexuous, branched, septate, smooth, light green. *Synnema* dark green, straight to slightly flexuous, unbranched, 230-610 µm x 10-45 µm wide. *Conidiogenous cells* holoblastic, terminal, pale green, smooth, 5-12.5 x 2-5 µm. *Conidia* catenate, simple, dry, light green, verrucose, flat at the base,

rounded at the apex, single celled, developing in acropetal chains, single conidia measures 5-8 x 4-6 μm .

Specimen examined: On living leaves of *Calamus* sp. (Arecaceae), Bondla, Ponda Goa, 02-08-03, Pratibha, J., Herb. No. GUBH P59; Culture No. GUFCC No. 4914.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately growing, attaining a diam. of 2.4 cm in 7 days, circular, cottony, off-white with black spore heads, margin smooth, reverse off-white.

Till date, 9 species of *Doratomyces* are described and all were associated with decaying plant litter (Ellis, 1971; 1976). This is first record of *D. nanus* as foliicolous.

69. *Drechslera cynodontis* (Marignoni) Subram. & B.L. Jain, 1966. *Curr. Sci.* 35: 354

(Fig.69a-c; 69d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, initially small, later coalescing to large patches, dark brown. *Colonies* on leaf spots effuse, brown, velvety. *Mycelium* partly immersed, partly superficial, composed of smooth, septate, branched, light brown, thick-walled 2-3 μm wide hyphae. *Conidiophores* macronematous, mononematous, solitary as well as fasciculate, brown, smooth, unbranched to rarely branched, septate, thick walled, 55-80 x 3-5.5 μm . *Conidiogenous cells* polytretic, terminal and intercalary, integrated, determinate, cicatrized, light brown, 17-28 x 3-5 μm , with thickened and darkened conidial scars. *Conidia* solitary, smooth, light brown with transverse and rarely oblique or longitudinal septa, 30-50 x 9-15 μm wide at the broadest part, 2-4 μm at the tip, with thickened and darkened hilum.

Specimen examined: On living leaves of *Tecoma stans* (Linn.) Kunth ex HBK. (Bignoniaceae), GU campus, Taleigao, Goa, 16/06/04, Pratibha, J., Herb. No. GUBH P130.

Fig. 67a-c: *Diplococcium spicatum*

67a- Leaf spots

67b- Conidiomata

67c- Conidia

Fig. 68a-c: *Doratomyces nanus*

68a- Leaf spots

68b- Conidiomata

68c- Coidiophores with conidia

Fig. 69a-c: *Drechslera cynodontis*

69a- Leaf spots

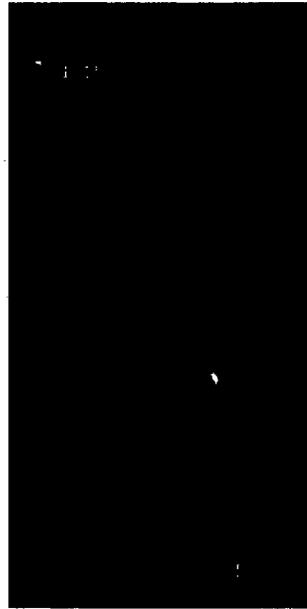
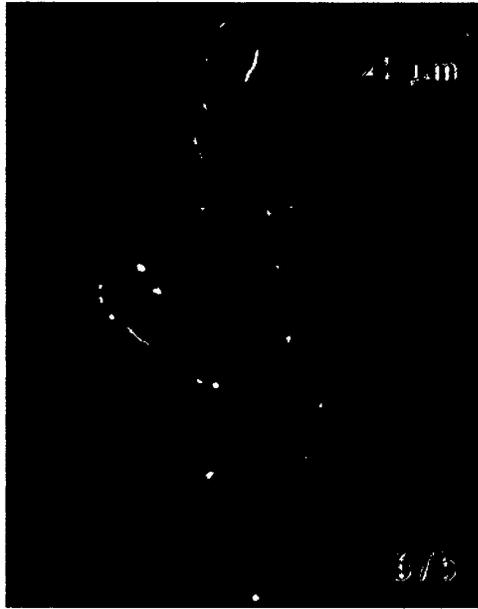
69b- Conidiomata

69c- Conidia

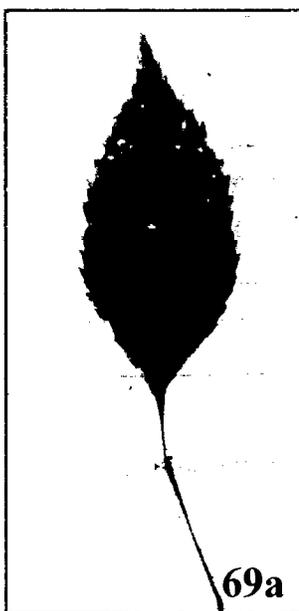
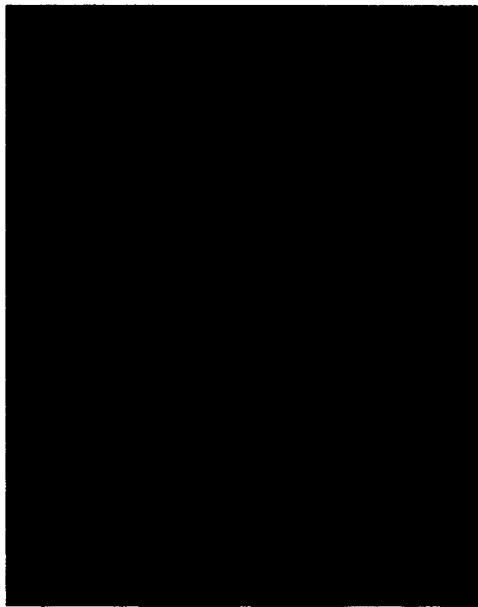
Fig. 67-69



67a



68a



69a



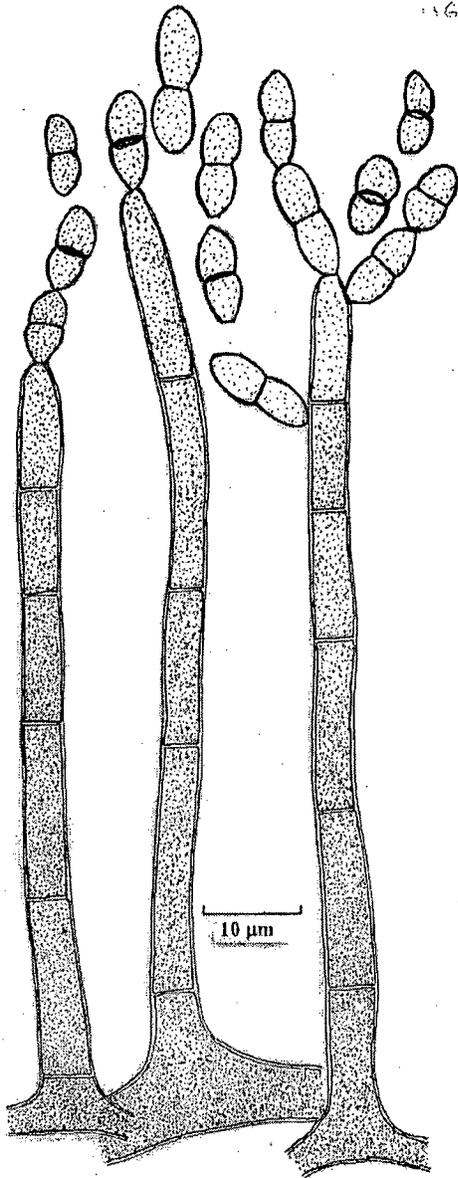


Fig. 67d *Diplococcium spicatum*

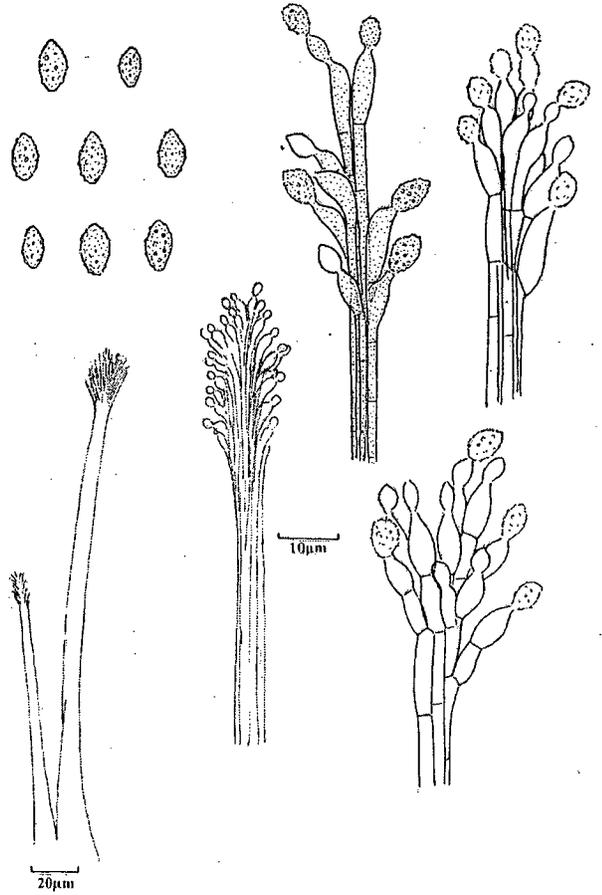


Fig. 68d *Doratomyces nanus*

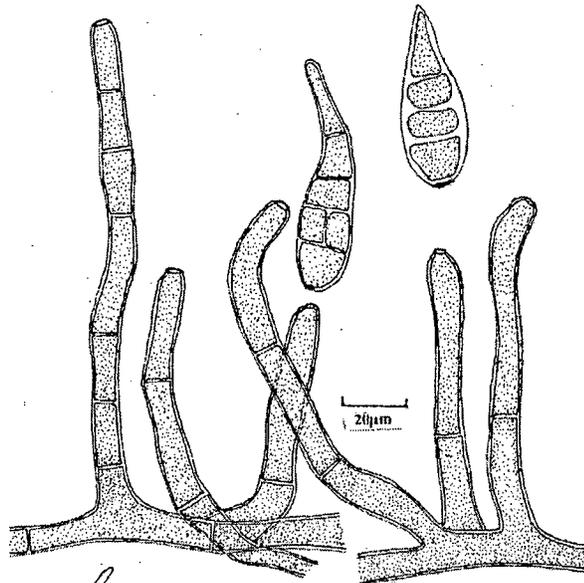


Fig. 69d *Drechslera cynodontis*

Almost all the species of the genus *Drechslera* are known to be litter inhabiting fungi (Ellis, 1971; 1976; Matsushima, 1971, 1975) and *D. cynodontis* is recorded for the first time as foliicolous.

70. *Excipularia narsapurensis* Subram., 1956. *J. Indian bot. Soc.* 35(1): 56

(Fig.70a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown with dark brown margin, later turning black, mostly observed at the tip of the leaf. *Colonies* on leaf spots effuse, dark brown to black, hairy. *Mycelium* immersed. *Stroma* none. Sporodochia scattered, black, shining with central mass of conidia supported by a ring of setae. *Setae* dark brown, thick-walled, smooth, septate, unbranched, acutely pointed at the tip, up to 250 μm long, 10-12 μm wide, *Conidiophores* macronematous, erect, straight to flexuous, unbranched, septate, smooth, pale brown, 25-30 x 4-6 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate. *Conidia* solitary, simple, acrogenous, broadly fusiform, dark brown in the middle, peripheral cells hyaline, 5-7 septate, 50-70 x 12-20 μm .

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Valpoi, Sattari Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P46.

Eight species of *Excipularia* are so far reported from all over the world as litter fungi. This is the first record of *E. narsapurensis* as foliicolous.

71. *Fusarium heterosporum* Nees & T. Nees, 1818. *Nova Acta Acad. Caes. Leop.-*

Carol. Nat. Cur. 9: 235

(Fig.71a-c; 71d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular, 7-10 mm wide, only one or two spots were observed on each leaf. *Colonies* on leaf spots effuse, off white, cottony. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, branched, 2-3 μm wide hyphae. *Stroma* none.

Fig. 70a-c: *Excipularia narsapurensis*

70a- Leaf spots

70b- Conidiomata

70c- Conidia

Fig. 71a-c: *Fusarium heterosporum*

71a- Leaf spots

71b- Conidiomata with setae and conidia

71c- Conidia

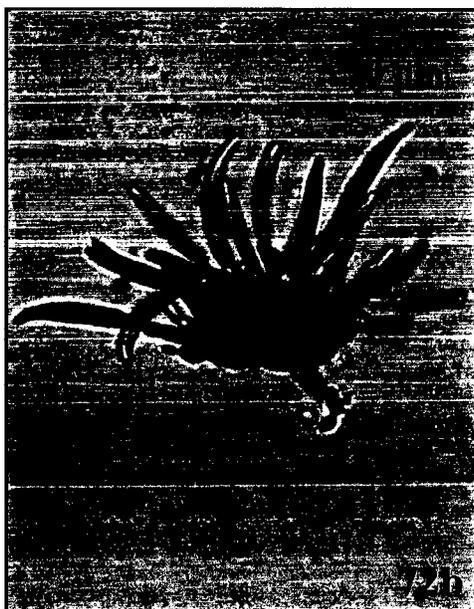
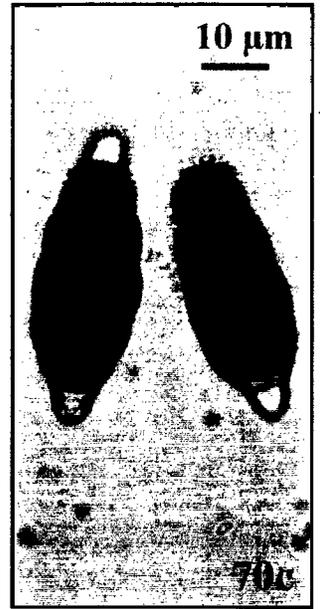
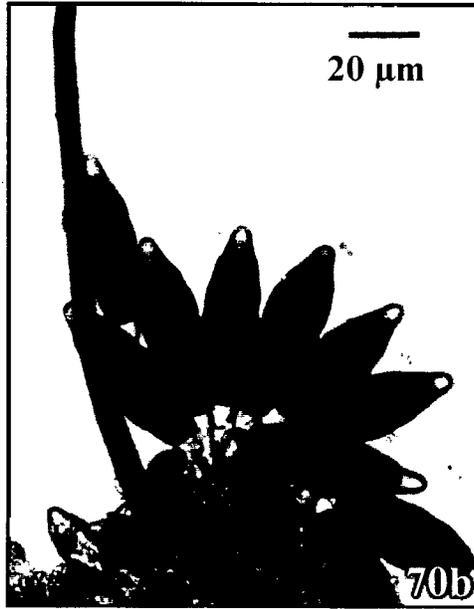
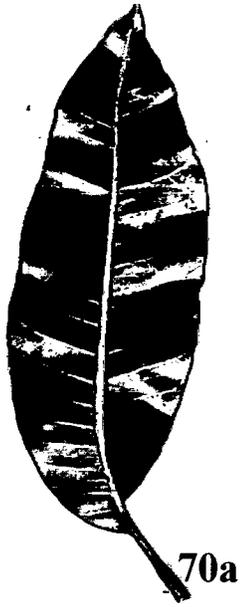
Fig. 72a-c: *Fusarium sambucinum*

72a- Leaf spots

72b- Conidiomata

72c- Conidia

Fig. 70-72



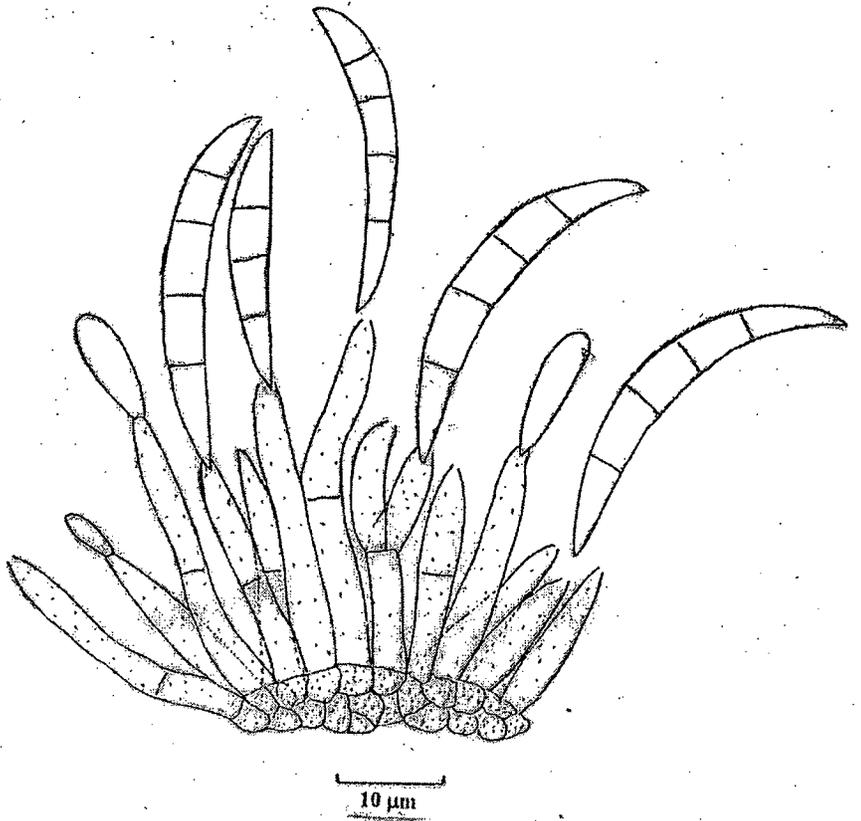


Fig. 72d *Fusarium sambucinum*

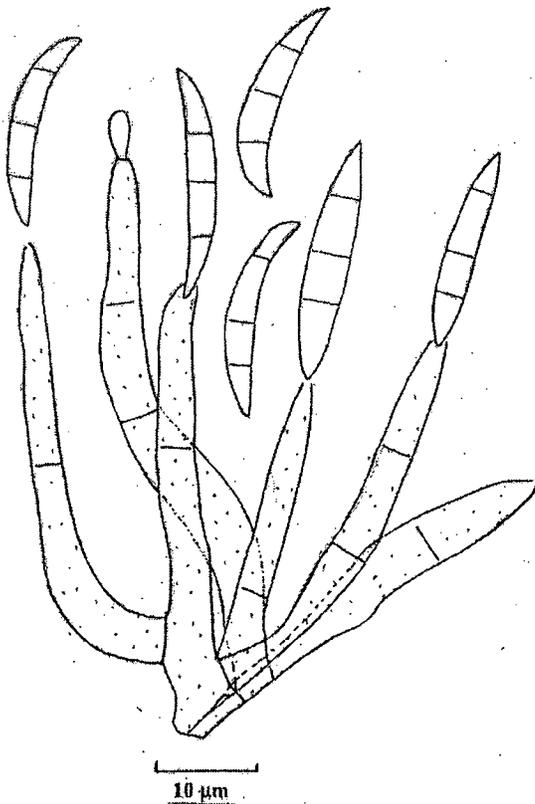


Fig. 71d *Fusarium heterosporum*

Setae and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, profusely branched, 0-1-septate, smooth, hyaline, thin-walled 10-30 x 3-5.5 μm . *Conidiogenous cells* monophialidic, terminal, integrated. *Conidia* solitary, endogenous, simple, fusiform, pointed at both the ends, hyaline, smooth, 1-3-septate, 30-50 x 3-5 μm .

Specimen examined: On living leaves of *Justicia adathoda*, GU Campus, Taleigao Goa, 08/10/03, Pratibha, J., Herb. No. GUBH P104.

72. *Fusarium sambucinum* Fuckel, 1869. *Symbolae mycologicae* 23-24: 167

(Fig.72a-c; 72d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular, 2-4 mm in diam, formed only at the tip of leaf. *Colonies* on leaf spots effuse, off white, cottony. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, branched, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, profusely branched, septate, smooth, hyaline, thin walled 27-55 x 2-4 μm . *Conidiogenous cells* monophialidic, terminal, integrated, 8-20 x 2-3.5 μm . *Conidia* solitary, simple, fusiform, pointed at both the ends, hyaline, smooth, 1-3-septate, 10-35 x 2.5-4.5 μm , in slimy heads at the tip of the phialide.

Specimen examined: On living leaves of *Justicia adathoda*, Banastari, Ponda Goa, 16/04/03, Pratibha, J., Herb. No. GUBH P29.

73. *Fusarium* sp.

(Fig.73a-c; 73d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey, irregular, 2-4 mm wide, observed on entire leaf surface. *Colonies* on leaf spots effuse, off white, cottony. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, branched, 1.5-2.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent.

Conidiophores macronematous, mononematous, fasciculate, erect, straight to flexuous, sometimes branched, septate, smooth, hyaline, thin walled, 40-87 x 2.5-3.5 μm . *Conidiogenous cells* monophialidic, terminal, integrated, 10-20 x 2-3 μm . *Conidia* solitary, simple, endogenous, rounded at both the ends, hyaline, smooth, 1-3 septate, 5-14 x 2-3.5 μm , aggregating in slimy heads at the tip of phialide.

Specimen examined: On living leaves of *Flacourtia* sp. (Flacourtiaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P206; Culture No. GUFCC No. 4915.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.5 cm in 7 days, circular, flat, off-white, margin smooth, reverse colourless.

Species of the genus *Fusarium* Link are generally reported from soil containing decomposing organic matter or on plant litter. Several species are also known as plant pathogens (Rangaswami and Mahadevan, 1999). The above 3 species are herewith reported as foliicolous fungi for the first time.

74. *Gonatobotryum epiphyticum* sp. nov.

(Fig.74a-c; 74d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white to grey, circular, 2-4 mm in diam. *Colonies* on leaf spots effuse, dark brown to black, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, unbranched to sometimes branched, septate, dark brown at the base, paler towards the apex, thick-walled, percurrently regenerating, nodose, 230-530 x 10-15 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, cicatrized, scars numerous, conspicuous. *Conidia* catenate, simple, dry, acropleurogenous, smooth, 2-3 septate, obclavate, sub-acute at the apex, truncate at the base, pale brown, smooth, pointed at both ends, 6-10 x 2-3.5 μm .

Holotype: On living leaves of *Nothopegia colebrookiana* (Wight) Blume (Anacardiaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P207; Culture No. GUFCC No. 4916.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 4.0 cm in 7 days, circular, powdery, dark brown, margin serrated, reverse black.

Nine hitherto described species of the genus *Gonatobotryum* Sacc. are all lignicolous on decomposing organic matter or plant litter. The above taxon is reported herewith as foliicolous and differs from so far described species with its branching conidiophores.

75. *Gonatophragmium mori* (Sawada) Deighton, 1969. In: Cejp & Deighton, *Mycol. Pap.* 117: 13 (Fig.75a-c; 75d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white to light brown, circular, in the form of concentric rings, 10-15 mm wide. *Colonies* on leaf spots effuse, grey, hairy. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, smooth, branched, septate, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, branched, septate, thin-walled, pale olivaceous brown, smooth, with swollen at the nodal region, 140-350 x 3-4.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, sympodial, 12-27 x 3-4 μm , with numerous scars. *Conidia* solitary, simple, dry, acropleurogenous, clavate, smooth, sub-hyaline, 0-1-septate, 8-17 x 3-4.5 μm .

Specimen examined: On living leaves of *Ficus asperrima* Roxb. (Moraceae), Puttur, Karnataka, India, 25/01/05, Prof. D.J. Bhat, Herb. No. GUBH P214; Culture No. GUFCC No. 4917.

Fig. 73a-c: *Fusarium* sp.

73a- Leaf spots

73b- Conidiomata

73c- Conidia

Fig. 74a-c: *Gonatobotryum epiphyticum*

74a- Leaf spots

74b- Conidiomata

74c- Conidiophore with conidia

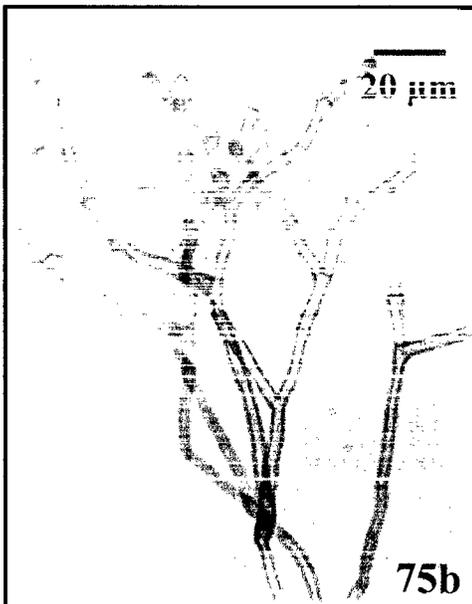
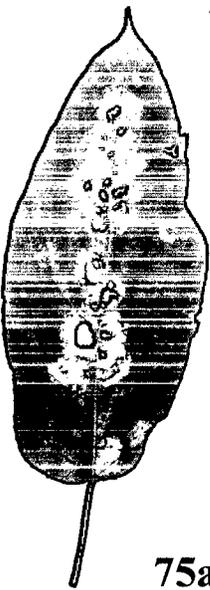
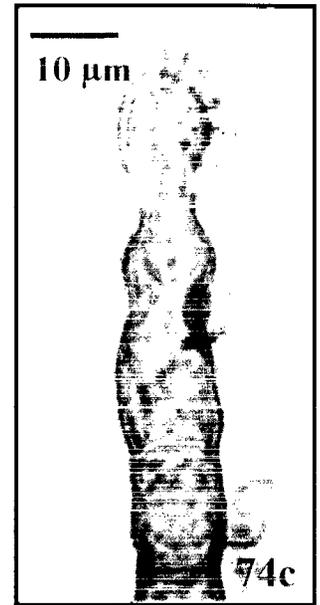
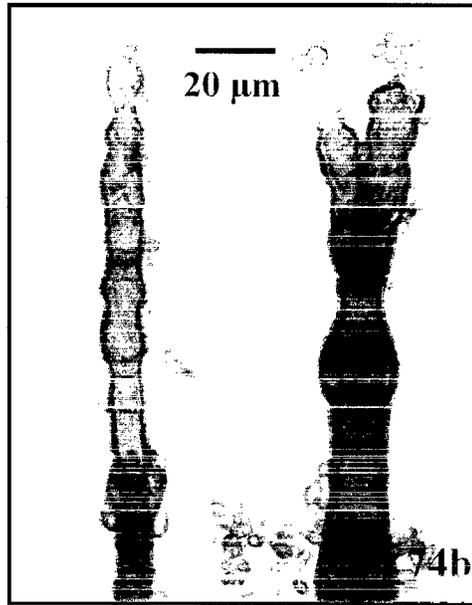
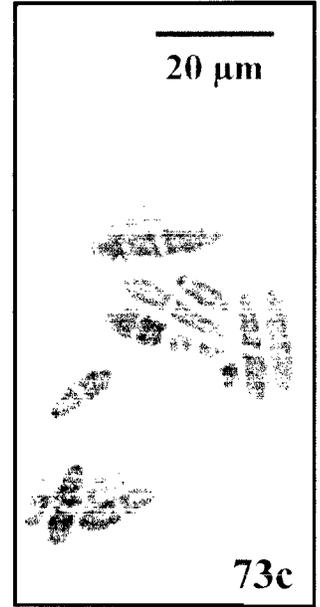
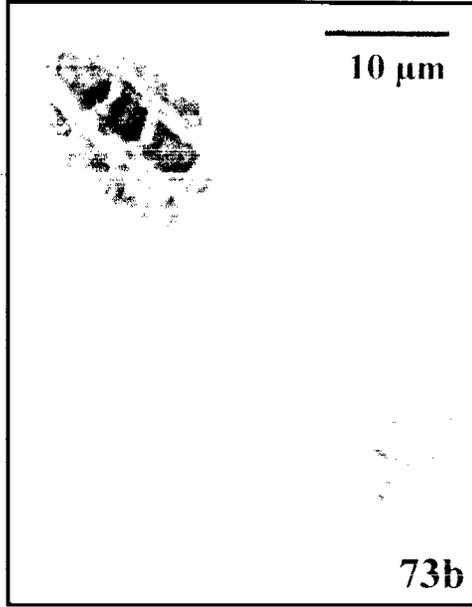
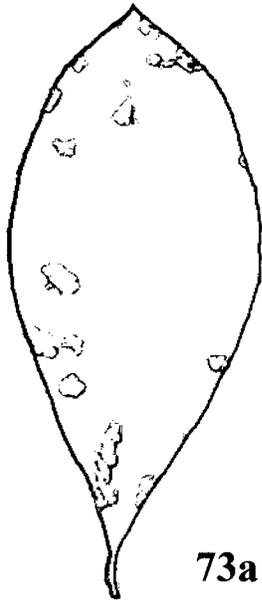
Fig. 75a-c: *Gonatophragmium mori*

75a- Leaf spots

75b- Conidiomata

75c- Conidiophore with conidia

Fig. 73-75



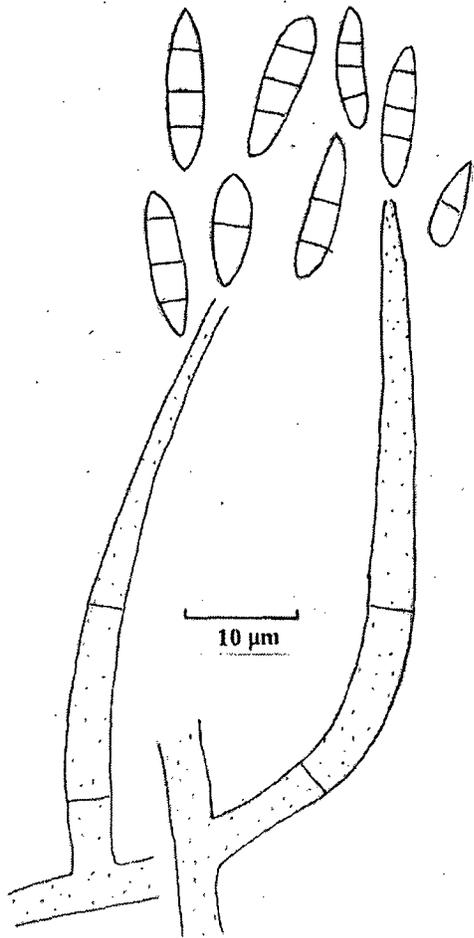


Fig. 73d *Fusarium* sp.

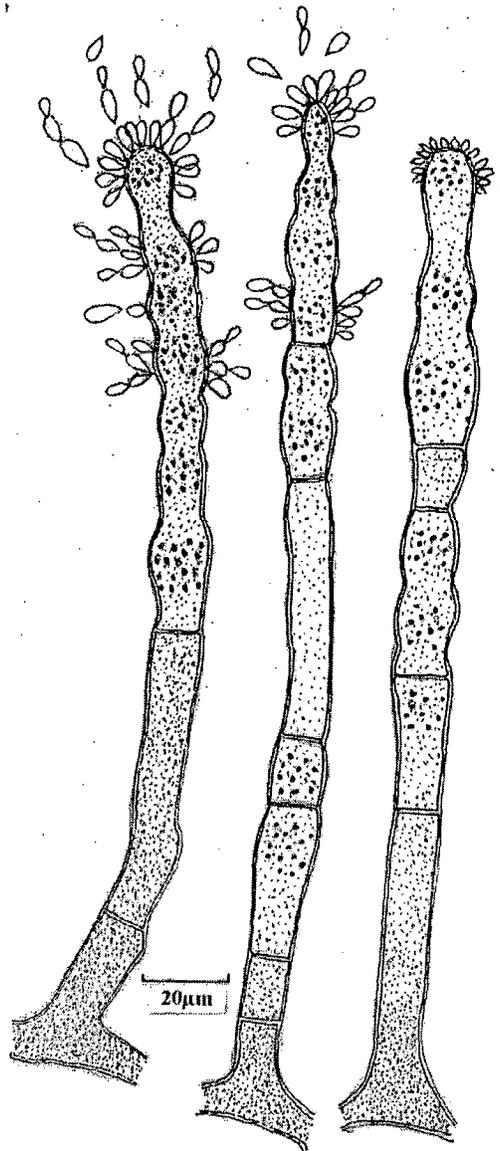


Fig. 74d *Gonatobotryum epiphyticum*

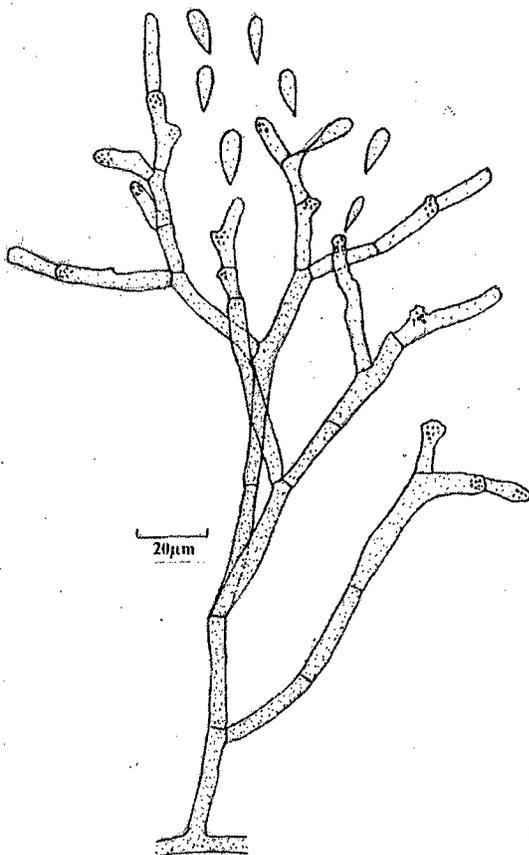


Fig. 75d *Gonatophragmium mori*

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 3.7 cm in 7 days, circular, leathery, light brown, margin serrated, reverse yellowish.

The only species of *Gonatophragmium*, i.e. *G. mori*, reported on the host genus *Ficus* as foliicolous from Goa region of the Western Ghats for the first time.

76. *Hansfordia pulvinata* (Berk. & M.A. Curtis) S. Hughes, 1958. *Can. J. Bot.* 36: 771. (Fig.76a-c; 76d)

Fungus Hyphomycete. *Leaf spots* amphigenous, semi-circular to irregular, brown, 2-6 cm wide, only one or two spots were seen on few leaves of the tree. *Colonies* on leaf spots effuse, grey, velvety. *Mycelium* partly immersed, partly superficial composed of smooth, sub-hyaline, septate, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, erect, straight to flexuous, branched, brown, smooth, up to 500 μm ; upper part of the conidiophore sterile, setiform, sub-hyaline. *Conidiogenous cells* polyblastic, integrated, terminal, determinate, denticulate, sub-hyaline, smooth, 10-20 x 1.5-3 μm . *Conidia* solitary, acropleurogenous, spherical, hyaline, minutely verrucose, 4-7 μm in diam.

Specimen examined: On living leaves of *Ficus benghalensis* Linn. (Moraceae), GU Campus, Tiswadi Goa, 25/01/03, Herb. No. GUBH P13; *Anacardium occidentale*, Calem, Sanguem Goa, 22/06/04, Herb. No. GUBH P135; Undetermined taxon, Calem, Sanguem Goa, 16-01-05, Pratibha, J., Herb. No. GUBH P187.

In the genus *Hansfordia* Hughes, typified by *H. ovalispora* Hughes, 20 species are so far described. Of these, several are known as litter fungi. *H. pulvinata* was reported earlier on dead wood as well as on leaves (Ellis, 1971, 1976).

77. *Hermatomyces tucumanensis* Speg., 1911. *Annals del Museo Nacional de Hist.*

Nat. de Buenos Aires 13: 446

(Fig.77a-c; 77d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to almost black, circular to semi-circular, 8-12 mm wide. *Colonies* on leaf spots effuse, dark brown to black, velvety. *Mycelium* partly immersed, partly superficial composed of smooth, sub-hyaline, septate, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous mononematous, erect, straight to flexuous, unbranched, brown, smooth, 10-15 x 2.5-4 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate. *Conidia* solitary acrogenous, spherical, brown to black, with pale peripheral cells surrounding the central dark brown to black cells, 25-32 μm in diam.

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P75.

So far described all 4 species in the genus *Hermatomyces* Speg., are known to be litter inhabiting fungi (Ellis, 1971). This is the first report of a species in the genus as foliicolous fungus.

78. *Isaria* sp.

(Fig.78a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown with dark brown margin, later turning black, mostly observed at the tip of the leaf. *Colonies* on leaf spots effuse, black, hairy. *Mycelium* partly immersed, partly superficial composed of smooth, hyaline, septate, 1.5-2 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, synnematous; synnema erect, straight to flexuous, unbranched, hyaline, 190-220 x 16-20 μm . *Conidiogenous cells* polyblastic, terminal, integrated, determinate, sympodial.

Fig. 76a-c: *Hansfordia pulvinata*

76a- Leaf spots

76b- Conidiomata

76c- Conidiophore with conidia

Fig. 77a-c: *Hermatomyces tucumanensis*

77a- Leaf spots

77b- Conidiomata

77c- Conidium

Fig. 78a-c: *Isaria* sp.

78a- Leaf spots

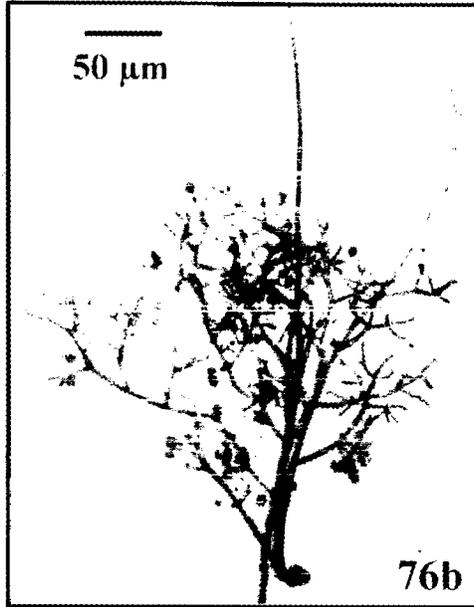
78b- Conidiomata

78c- Conidiophores with conidia

Fig. 76 -78



76a



50 µm

76b

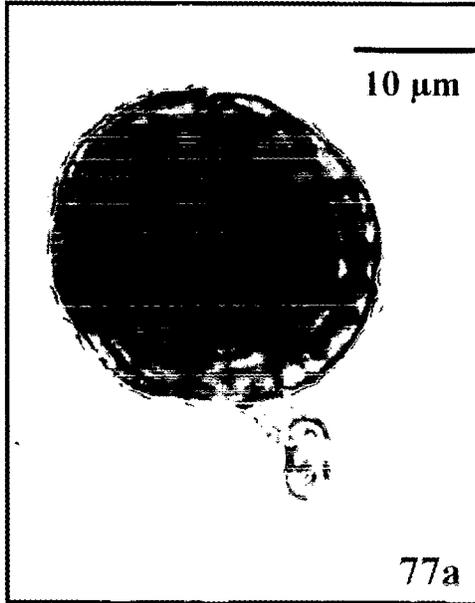


10 µm

76c

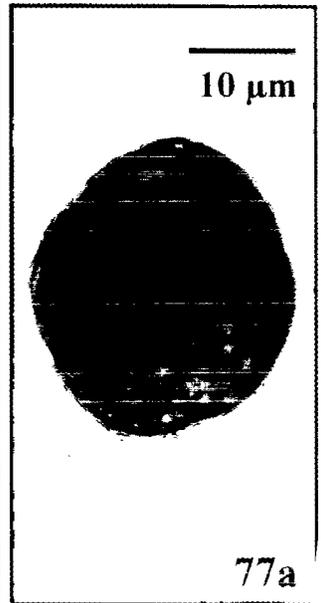


77a



10 µm

77a



10 µm

77a

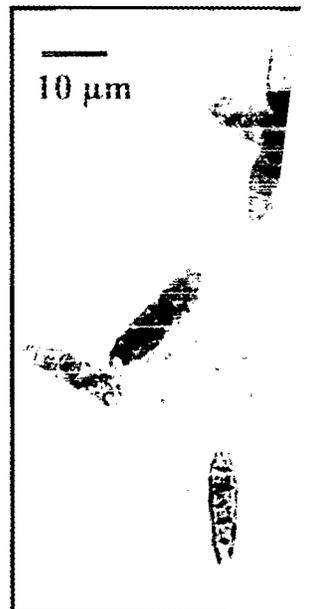


78a



10 µm

78b



10 µm

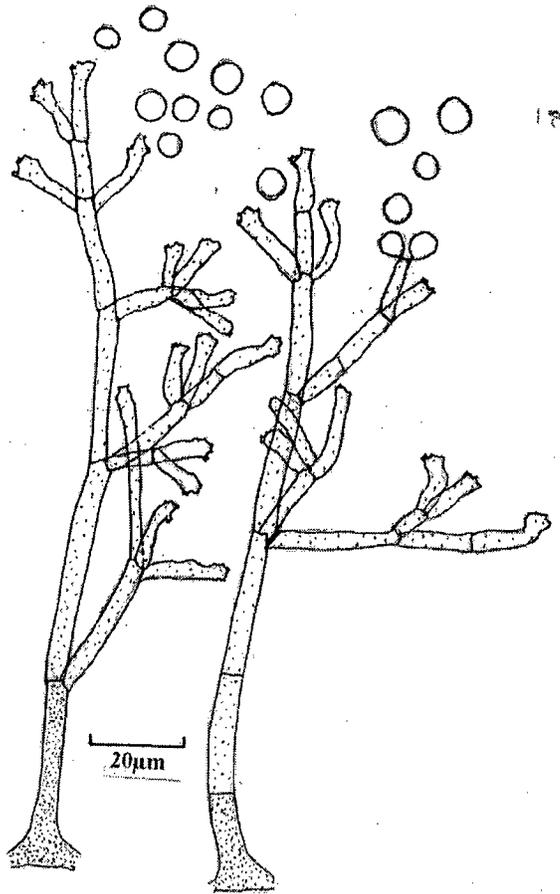


Fig. 76d *Hansfordia pulvinata*

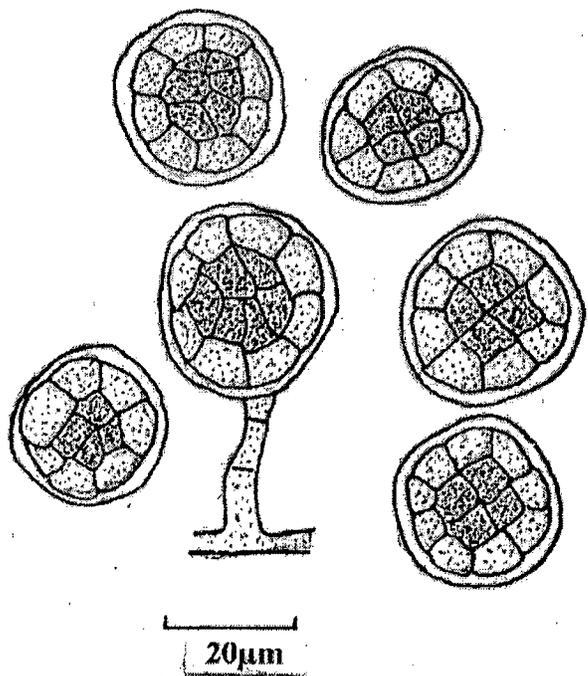


Fig. 77d *Hermatomyces tucumanensis*

Conidia solitary, simple, acropleurogenous, pale olivaceous, obclavate, smooth, 5-6-septate, 35-50 x 8-14 μm .

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Valpoi, Sattari Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P43.

All hitherto described species in the genus *Isaria* Persoon are litter-inhabiting fungi (Carmichael et al. 1980). This is the first report of a species in the genus as foliicolous fungus.

79. *Janetia* sp.

(Fig.79a-c; 79d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular. *Colonies* on leaf spots effuse, dark brown to black, velvety. *Mycelium* partly immersed, partly superficial, composed of hyaline, smooth, branched, septate, 2-4 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, solitary, unbranched, septate, smooth, thick walled, dark brown, 10-15 x 4-5 μm . *Conidiogenous cells* mono to polyblastic, integrated, terminal, smooth, denticulate with unthickened not darkened, flat-topped conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, obclavate, brown, smooth, pluriseptate, truncate at the base, 40-60 x 8-11 μm .

Specimen examined: On living leaves of *Ficus asperrima* Roxb. (Moraceae), Nanoda, Sattari, Goa, India, 21/01/05, Ashish, P., Herb. No. GUBH P218.

Species of the genus *Janetia* M.B. Ellis, are lignolytic and generally occur on decaying bark or twigs (Ellis, 1976). This is the first report of a species in the genus as foliicolous.

80. *Kramasamuha sibika* Subram. & Vittal, 1973. *Can. J. Bot.* 51(6): 1129

(Fig.80a-c; 80d)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, later turning to

black, irregular patches covering half the surface of leaf. *Colonies* on leaf spots effuse, dark brown, velvety. *Mycelium* partly immersed, partly superficial, composed of smooth, branched, septate, hyaline, 2-4 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, thick walled, branched, septate, dark brown below, paler towards the apex 100-230 x 3-4.5 μm . *Conidiogenous cells* monoblastic, discrete, terminal, light olivaceous, 5.5-x 12.5 x 2-3 μm . *Conidia* solitary, dry, simple, ellipsoidal, smooth, 2-4 septate, middle cell brown, end cells pale brown, apex rounded, base narrow with a remnant of attachment, 25-60 x 7-13 μm .

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Banastari, Ponda Goa, 21/01/03, Herb. No. GUBH P10; Valpoi, Sattari, Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P10.

The so far described 3 species of *Kramasamuha* Subram. & Vittal, including the type *K. sibika*, are litter inhabiting fungi (D'Souza, 2002). This is the first report of *K. sibika* as foliicolous.

81. *Menisporopsis theobromae* Hughes, 1952. *Mycol. Pap.* 48: 59 (Fig.81a-c; 81d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, off white to grey, initially tiny, later coalescing to form large patches, 2-8 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* none. *Setae* simple, dark brown, septate, smooth, solitary, lower part completely encased by the conidiophores, 195-280 x 3.5-5.5 μm . *Hyphopodia* absent. *Conidiophores* macronematous, synnematous, encasing lower part of the *Setae*. Single filament unbranched, straight to slightly flexuous, pale brown, wavy, 165-235 x 2.5-4 μm . *Conidiogenous cells* monophialidic, terminal, integrated, percurrent with collarette. *Conidia* aggregated in slimy heads, semi-endogenous, appendiculate with setula at

Fig. 79a-c: *Janetia* sp.

79a- Leaf spots

79b- Conidiomata

79c- Conidium

Fig. 80a-c: *Kramasamuha sibika*

80a- Leaf spots

80b- Conidiomata

80c- Conidium

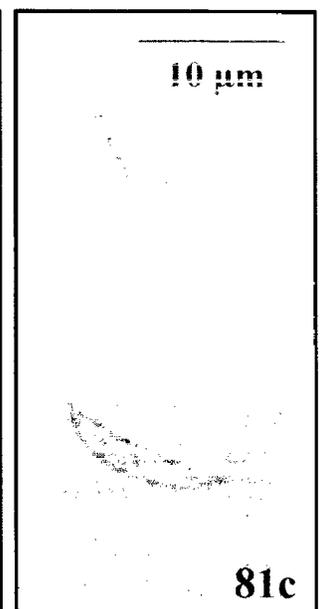
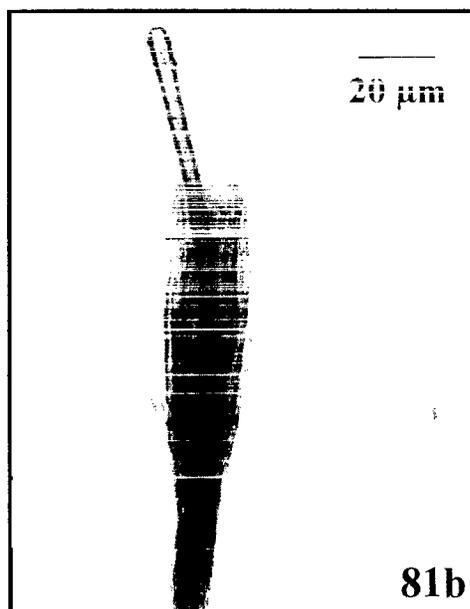
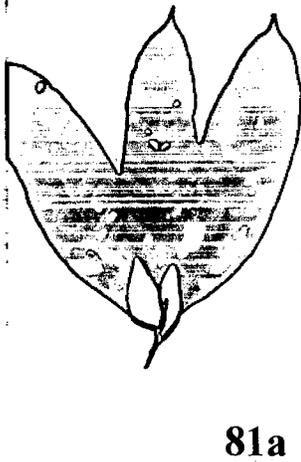
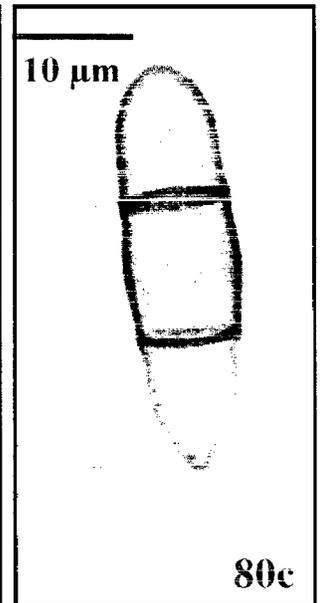
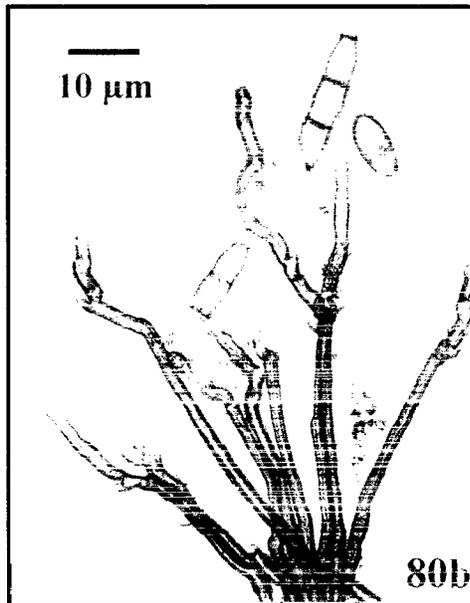
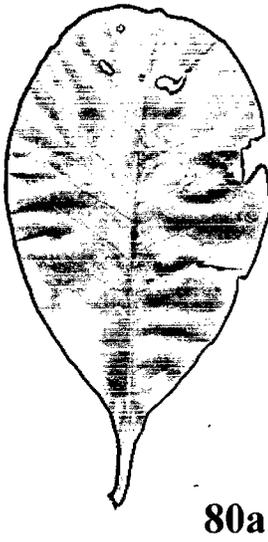
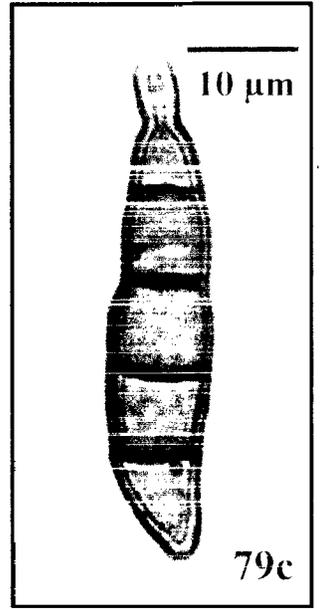
Fig. 81a-c: *Menisporopsis theobromae*.

81a- Leaf spots

81b- Conidiomata

81c- Conidia

Fig. 79-81



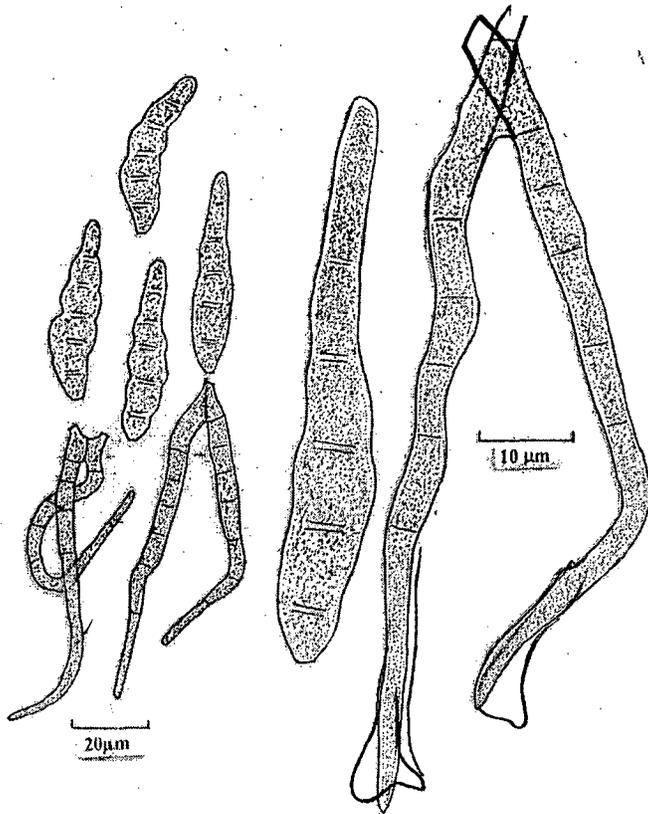


Fig. 79d *Janetia* sp.

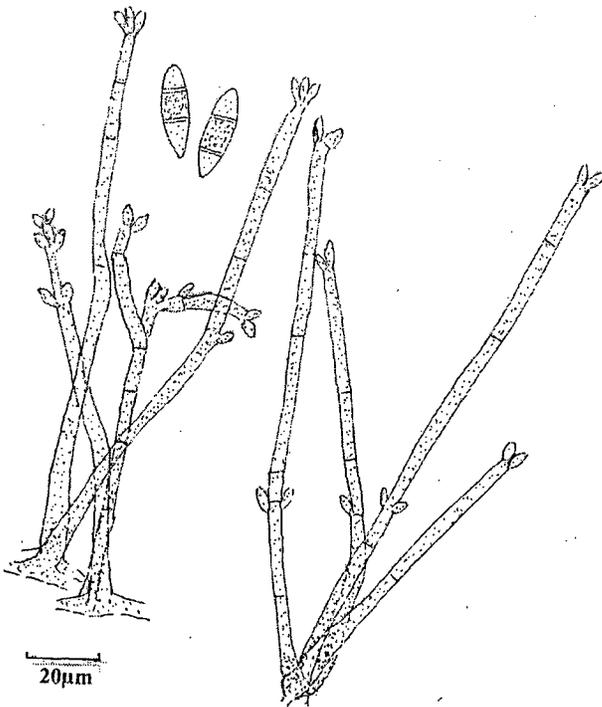


Fig. 80d *Kramasamuha sibika*

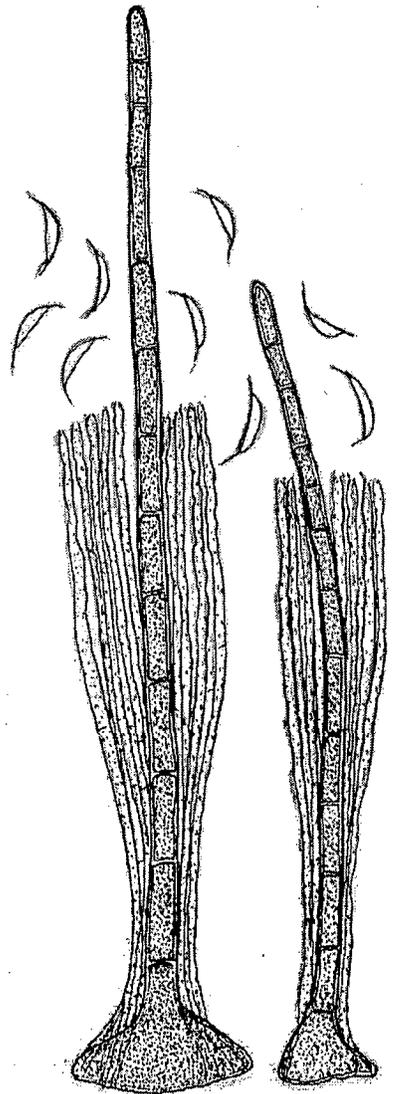


Fig. 81d *Menisporopsis theobromae*

each end, fusiform, pointed at both ends, hyaline, aseptate, 11.5-15.5 x 2-3.5 μm .
setulae thin, hyaline, 5-8 μm long.

Specimen examined: On living leaves of *Nothopegia colebrookiana* (Wight) Blume (Anacardiaceae), Chorla, Sattari, Goa, 02/07/04, Herb. No. GUBH P142; *Leea* sp. Amboli, Maharashtra, India, 17/07/04, Pratibha, J., Herb. No. GUBH P155; Culture No. GUFCC No. 4918.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.7 cm in 7 days, circular, powdery, dark brown, margin serrated, reverse off-white.

Till date, 11 species are described in the genus *Menisporopsis* Hughes, from decaying plant litter (Ellis, 1971; 1976; Tsui et al., 1999). *M. theobromae*, for the first time, is reported as foliicolous.

82. *Monodictys* sp.

(Fig.82a-c; 82d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular, 5-8 mm wide. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* superficial, composed of long, branched, smooth, hyaline, septate, thin-walled, 2-3.5 μm broad hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* micronematous, mononematous, solitary, unbranched, septate, smooth, light olivaceous, 4-6 x 2-4 μm . *Conidiogenous cells* monoblastic, terminal, integrated. *Conidia* solitary, simple, dark brown, verrucose, semispherical, 5.5-15.5 μm in diam.

Specimen examined: On living leaves of *Psidium guajava* L. (Myrtaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P72.

Species of the genus *Monodictys* Hughes are lignolytic and generally occur on decaying bark or twigs (Ellis, 1971, 1976; Matsushima, 1971, 1975). This is the first report of a species in the genus as foliicolous.

83. *Mycovellosiella eupatorii-odorati* (J.M. Yen) J.M. Yen, 1981. *Bull. Trimest. Soc.*

mycol. Fr. 97(3): 131

(Fig.83a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown to black, spreading throughout the leaf surface, almost all old as well as young leaves showed the infection, 2-8.5 mm wide. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Stroma* spherical, brown, pseudoparenchymatous, 30-40 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large, dense fascicles, erect, straight, arising from stromata, unbranched, 0-1-septate, smooth, pale brown, 15-20 x 3-4.5 µm. *Conidiogenous cells* monoblastic, terminal, determinate, integrated, denticulate, with unthickened, velvety conidial scars. *Conidia* mostly solitary, rarely catenate, dry, acrogenous, straight to slightly curved, slightly verrucose, light olivaceous, pluriseptate, scolecosporous, hilum thickened, not darkened, 25- 67.5 x 2-3.5 µm; ramoconidia present.

Specimen examined: On living leaves of *Chromalina odorata* (Linn.) King & Robinson (F: Asteraceae), Banastari, Ponda Goa, 01/01/03, Herb. No. GUBH P1; Goa University Campus, 26/02/04; Pilgao, Bicholim Goa, 10/03/03, Herb. No. GUBH P1(a); Mashem, Canacona Goa, 16/10/04 Herb. No. GUBH P1(b); Colem, Sanguem Goa, 30/07/05, Herb. No. GUBH P1(c); Bondla, Ponda Goa, 08/07/05, Pratibha, J., Herb. No. GUBH P1(d); Culture No. GUFCC No. 4919.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.5 cm in 7 days, circular, leathery, dark brown, margin serrated, reverse off-white.

Three species of *Mycovellosiella* Rangel, viz. *M. costaricensis*, *M. eupatorii-odorati* and *M. perfoliata*, are so far recorded on *Chromolina*. In the present study, *M. eupatorii-odorati* has been isolated from 5 different localities, on the same host, and this clearly indicates the specificity of the fungus with its host.

Fig. 82a-c: *Monodictys* sp.

82a- Leaf spots

82b- Conidiomata

82c- Conidium

Fig. 83a-c: *Mycovellosiella eupatorii-odorati*

83a- Leaf spots

83b- Conidiomata

83c- Conidium

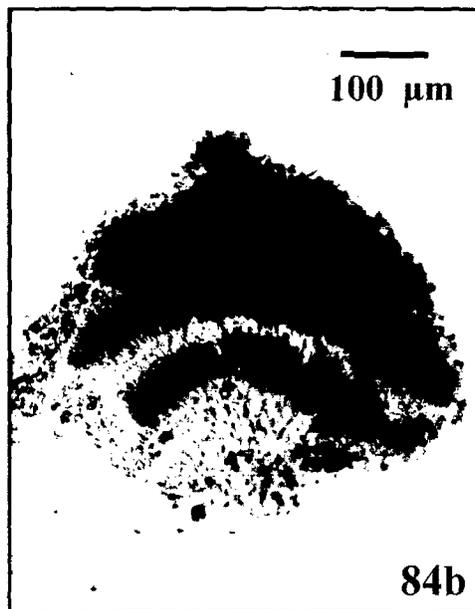
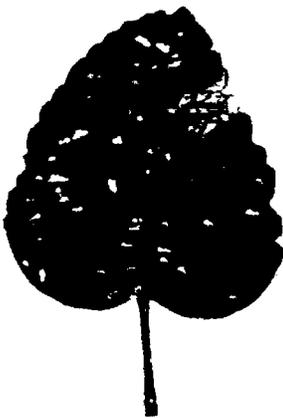
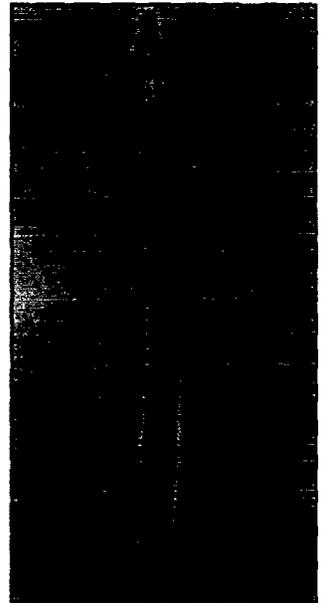
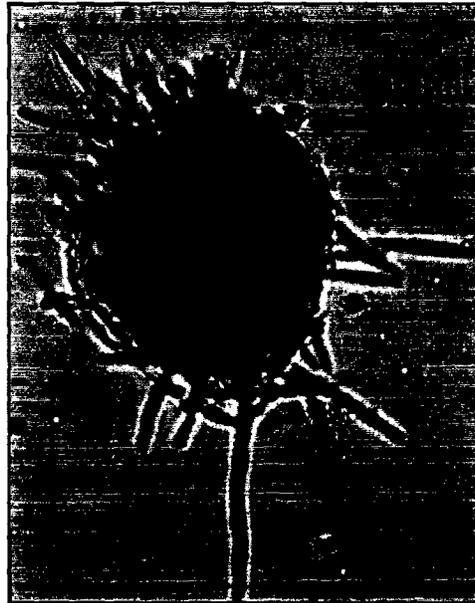
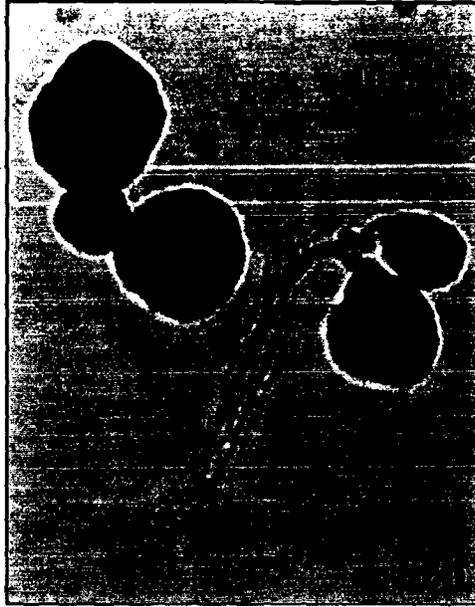
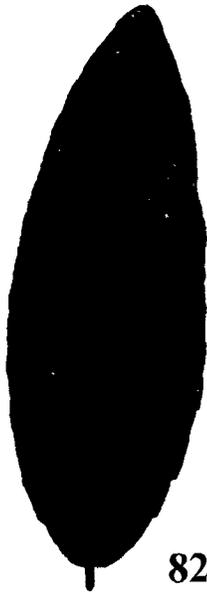
Fig. 84a-c: *Myrothecium roridum*.

84a- Leaf spots

84b- Sporodochia

84c- Conidiophore with conidia

Fig. 82-84



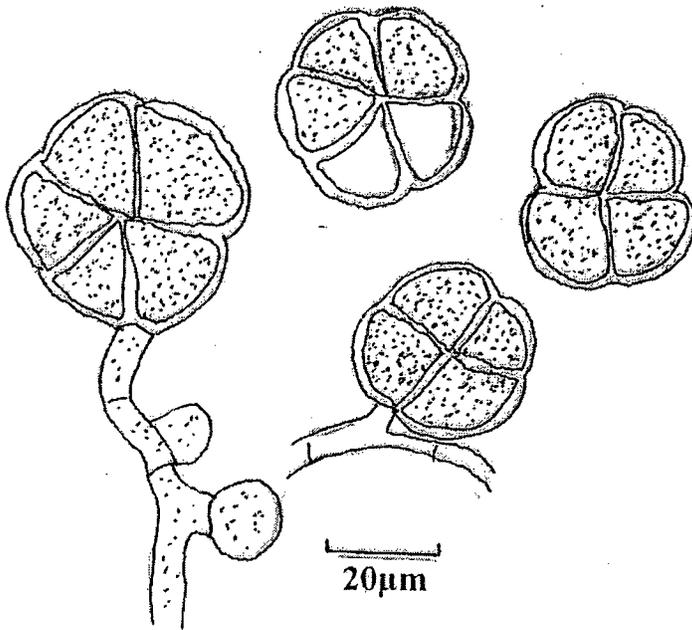


Fig. 82d *Monodictys* sp.

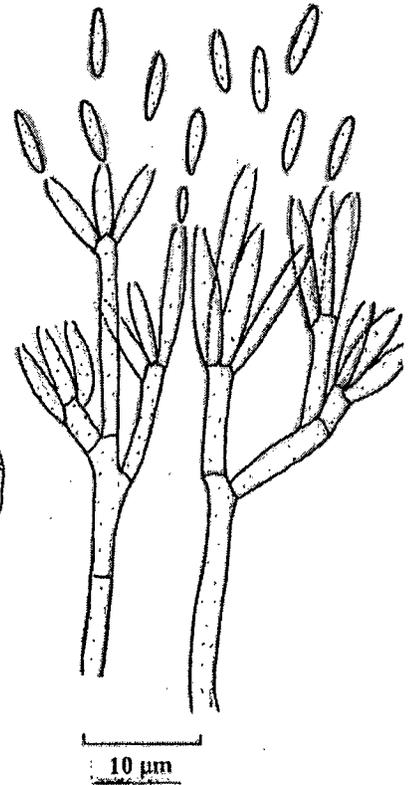
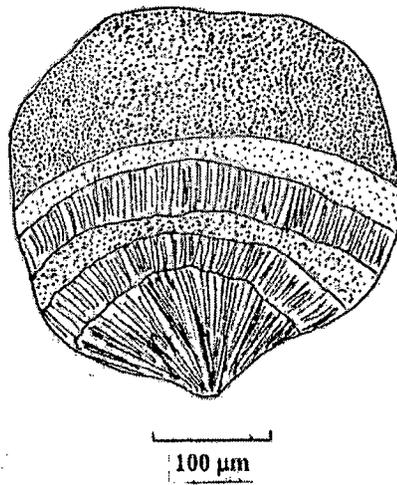


Fig. 84d *Myrothecium roridum*

84. *Myrothecium roridum* Tode ex Fr. 1829. *Syst. Mocol.* 3: 217 (Fig.84a-c; 84d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown to black with grayish center, the spots later collapse leaving the shot holes in the center, 2-5 mm in diam. *Colonies* on leaf spots effuse, dark green to black, velvety. *Mycelium* partly immersed, partly superficial, composed of long, slender, thin, branched, smooth, hyaline, septate, thin-walled, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. Sporodochia sessile, with a dark green to black mass of conidia usually surrounded by a zone of white, flocculent hyphae, up to 450 μm long. *Conidiophores* macronematous, mononematous, compactly arranged to form a sporodochium, straight, hyaline, smooth, septate, branched, 100-150 x 3-4.5 μm . *Conidiogenous cells* monophialidic, terminal, discrete, cylindrical, 10-12.5 x 2-3.5 μm . *Conidia* aggregated in dark green to black slimy heads at the tip of sporodochia, simple, aseptate, light olivaceous, 4-7 x 1.5-2 μm .

Specimen examined: On living leaves of *Hibiscus rosa-sinensis* Linn. (Malvaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P73; Culture No. GUFCC No. 4920.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 4.1 cm in 7 days, circular, flat, white with dark green spore heads, margin serrated, reverse off-white.

Species of *Myrothecium* Tode ex Fr. are cosmopolitan in distribution and found associated with decaying plant litter, soil organic matter as well on green leaves causing leaf spots (Ellis, 1971, 1976; Matsushima, 1975).

85. *Nigrospora sphaerica* (Sacc.) E.W. Mason, 1927. *Trans. Br. mycol. Soc.* 12: 158 (Fig.85a-c; 85d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, dark brown to black, 5-7 mm wide, only one or two spots were observed on few leaves of

the tree. *Colonies* on leaf spots effuse, dark brown to black. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, hyaline, branched, septate, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, solitary, erect, straight to flexuous, unbranched, septate, smooth, hyaline to light olivaceous, 14-45 x 3-6 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate, sub spherical, hyaline, swollen at the upper part, ampulliform, 7-11 x 3-6 μm . *Conidia* solitary, aseptate, spherical, compressed dorsiventrally, black, smooth, shiny, 9-16 μm in diam.

Specimen examined: On living leaves of *Erythrina indica* Linn. (Fabaceae), Donapaula, Tiswadi, Goa, 13/11/03, Pratibha, J., Herb. No. GUBH P113.

So far 15 species of *Nigrospora* Zimmermann are known. All were generally considered as litter fungi (Ellis, 1971; 1976). Some of them have also been reported as endophytes (Jacob, 2000). *N. sphaerica* has been mostly isolated from food stuff and soil (Ellis, 1971). This is first record of the fungus as foliicolous.

86. *Passalora bougainvilleae* (Munt.-Cvetk.) R.F. Castañeda & U. Braun, 1991. In: Braun & Castañeda Ruiz, *Cryptogamic Botany* 2(2-3): 291 (Fig.87a-c; 87d)

Fungus Hyphomycete. *Leaf spots* amphigenous, brown, in the form of concentric rings, with white spot in the center, circular to irregular, spreading on entire leaf surface, all young to senescing leaves showed the infection, 2-10 mm in wide. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Stroma* dark brown, parenchymatous, 30-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large fascicles, more or less dense, arising from stromata, erect, straight, unbranched, 0-1-septate, dark brown, smooth, 20-4 x 4-8 μm . *Conidiogenous cells* integrated, terminal, sometimes intercalary, determinate, polyblastic, sympodial, cicatrized, with thickened

and darkened conidial scars, 15-35 x 4-7 μm . *Conidia* mostly solitary, dry, simple, acropleurogenous, straight, pale brown, minutely verrucose, clavate, sub-obtuse to obtuse at the apex, truncate the base, hilum thickened and darkened, 20-60 x 6-9 μm .

Specimen examined: On living leaves of *Bougainvillea spectabilis* Willd (Nyctaginaceae), University campus, Taleigao Goa, 01/01/03, Herb. No. GUBH P3; Asagao, Bardez Goa, 14/05/03, Herb. No. GUBH P3; Campal, Tiswadi Goa, 16/08/03, Pratibha, J., Herb. No. GUBH P3; Culture No. GUFCC No. 4921.

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 0.5 cm in 7 days, irregular, cartilaginous, dark brown, margin serrated, reverse black.

Only one species of *Passalora* Fries has so far been reported from the host genus *Bougainvillea*. In the present study, *P. bougainvilleae* was isolated from 3 different localities indicating its host specificity.

87. *Passalora personata* (Berk. & M.A. Curtis) S.A. Khan & M. Kamal, *Pakist. J. scient. ind. Res.* 13: 188 (1961) (Fig. 86a-c86d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, initially yellow later turning dark brown to black in the centre with yellow halo, 2-4 mm in diam., spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* light brown, parenchymatous, 30-40 μm in diam. *Conidiophores* macronematous, mononematous, in dense fascicles, brown, smooth, unbranched, septate, thick-walled, erect, straight to slightly flexuous, 55.5-75.5 x 5.5-9.0 μm . *Conidiogenous cells* polyblastic, sympodial, integrated, terminal and intercalary, cicatrized, conidial scars thickened and darkened. *Conidia* solitary, simple, 1-3 septate, acropleurogenous, smooth, thick-walled, light brown, obclavate, rounded at the tip, truncate at the base, hilum thickened and darkened, 16.5-53.5 x 4.5-7.5 μm .

Fig. 85a-c: *Nigrospora sphaerica*

85a- Leaf spots

85b- Conidiomata

85c- Conidiophore with conidium

Fig. 86a-c: *Passalora personata*

86a- Leaf spots

86b- Conidiomata

86c- Conidium

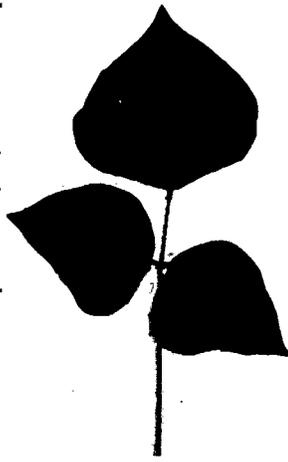
Fig. 87a-c: *Passalora bougainvilleae*

87a- Leaf spots

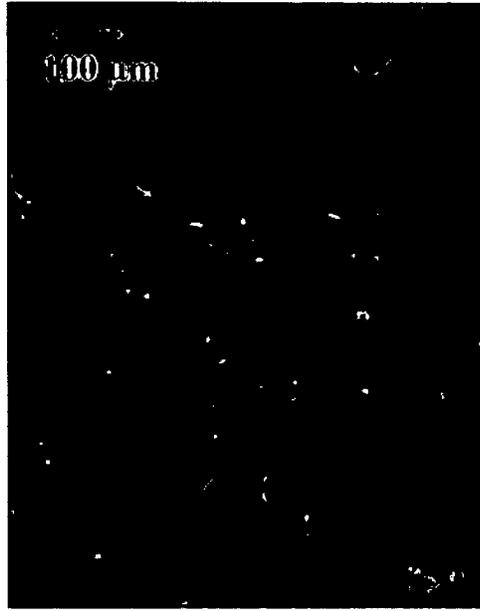
87b- Conidiomata

87c- Conidia

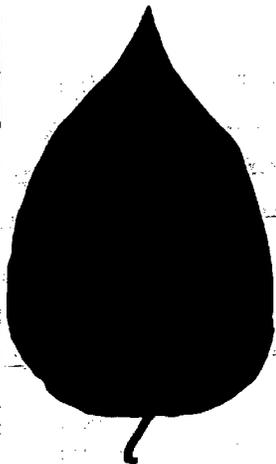
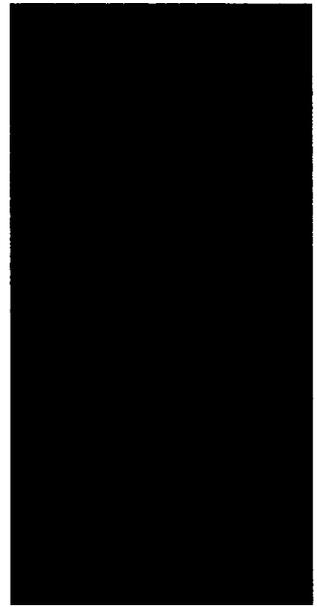
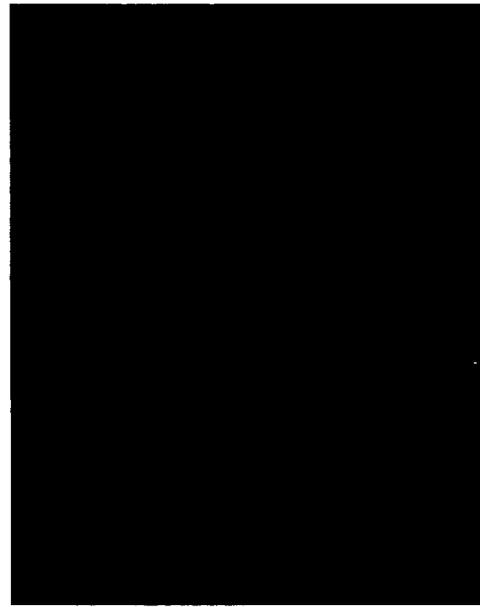
Fig. 85-87



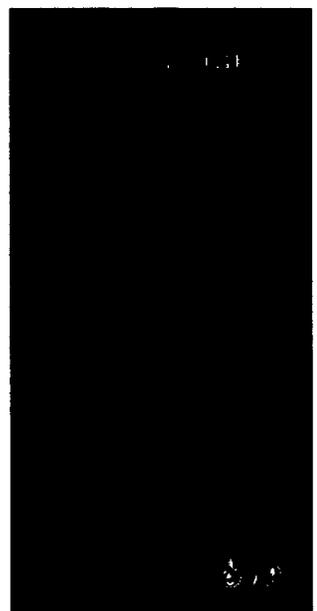
85a



86a



87a



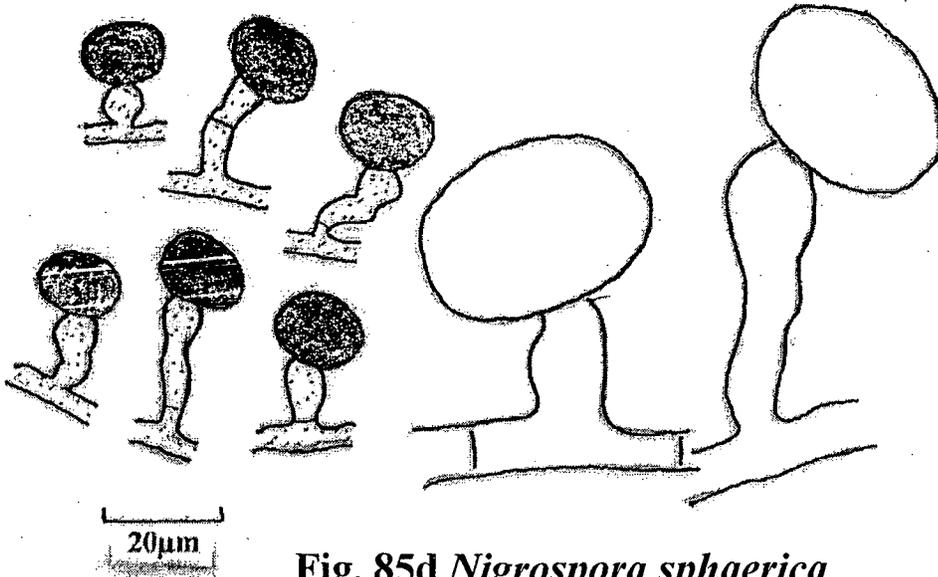


Fig. 85d *Nigrospora sphaerica*

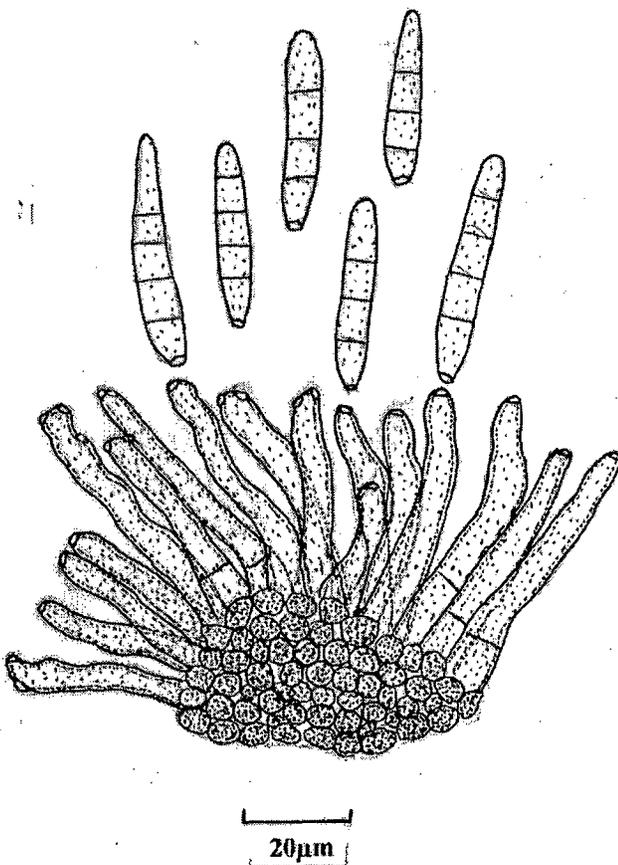


Fig. 86d *Passalora personata*

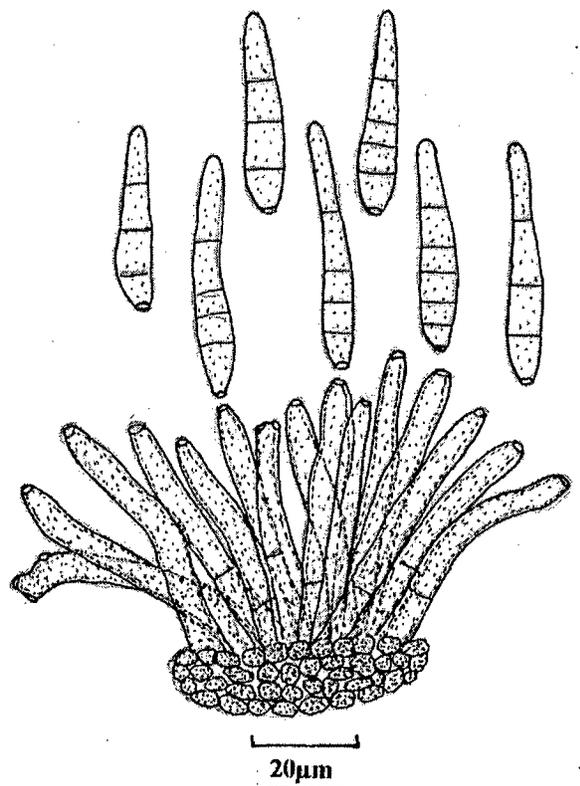


Fig. 87d *Passalora bougainvilleae*

Specimen examined: On living leaves of *Arachis hypogea* Linn. (Fabaceae) ICAR campus, Tiswadi, Goa, 10/04/04, Pratibha, J., Herb. No. GUBH P126.

Till date, 2 species of *Passalora*, i.e. *P. arachidicola* and *P. personnata*, were known on the host genus *Arachis*. Isolated species was assigned to *P. arachidicola* in view of its similarities in morphology and dimension of conidiophores and conidia.

88. *Passalora* sp.1

(Fig.88a-c; 88d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, greyish brown. *Colonies* on leaf spots effuse, light brown. *Mycelium* immersed. *Stroma* large, spherical, olivaceous with loosely arranged cells, 70-80 μm in diam. *Conidiophores* macronematous, mononematous, in large, dense fascicles, arising from stromata, erect, straight, unbranched, septate, light brown, smooth, 20-35.5 x 2-4.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, conidial scars thickened, somewhat darkened. *Conidia* solitary, acrogenous, filiform, light olivaceous, smooth, hilum unthickened, not darkened, 27.5-62.5 x 3-4.5 μm .

Specimen examined: On living leaves of *Gliricidia sepium* (Jacq.) Kunth ex Steud. (Papilionaceae), Banastari Ponda Goa, 25-08-03, Herb. No. GUBH P65; University Campus, Taleigao Goa, 17/11/03, Pratibha, J., Herb. No. GUBH P65.

89. *Passalora* sp.2

(Fig.89a-c; 89d)

Fungus Hyphomycete. *Leaf spots* amphigenous, pale brown, circular, margin dark brown with white spot in the centre, 1-3 mm in diam, present entirely on the surface of the leaf. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, slender, smooth, light olivaceous, 1.5-2.5 μm wide hyphae; *Stroma* brown, not well developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large loose fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, light brown, 50-250.5 x 3.5-5.5 μm , conidial scars thickened and darkened, rim like.

Conidiogenous cells polyblastic, terminal, later becoming intercalary, sympodial, determinate, integrated, cicatrized. *Conidia* solitary, light brown, pluriseptate, obclavate, base rounded, tip sub-obtuse, smooth, 47.5 x 7.5-11.5 µm, hilum thickened and darkened.

Specimen examined: On living leaves of *Vigna unguiculata* (Linn.) Walp. (Papilionaceae), Banastari, Ponda Goa, 15/03/03, Pratibha, J., Herb. No. GUBH P26.

The above 2 species of *Passalora* remained unidentified to species level at this stage in view of lack of relevant literature.

90. *Periconia byssoides* Pers., 1801. *Syn. meth. fung.* (Göttingen): 18

(Fig.90a-c; 90d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, semicircular to irregular, 10-15 mm in diam., spots developed on entire leaf surface. *Colonies* on leaf spots effuse, black, hairy. *Mycelium* partly immersed, partly superficial, composed of smooth, branched, septate, hyaline to light olivaceous, 3-4 µm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, thick walled, dark brown, unbranched, septate, 250-500 x 12-20 µm. *Conidiogenous cells* polyblastic, discrete, terminal, determinate, 80-95 x 118-11 µm. *Conidia* catenate, dry, simple, globose, verrucose, aseptate, smooth, thick walled, dark brown, 10-18 µm in diam.

Specimen examined: On living leaves of *Grewia microcos* Linn. (Tiliaceae), Banastari, Ponda Goa, 07/01/03, Herb. No. GUBH P9; Pilgao, Bicholim, Goa, 10/03/03, Pratibha, J., Herb. No. GUBH P9.

So far nearly 170 species of *Periconia* Pers. have been described, mostly as litter fungi. Some were also known to cause leaf spots (Ellis, 1971; 1976). *P. byssoides* was isolated from two different places from the same host.

Fig. 88a-c: *Passalora* sp.1

88a- Leaf spots

88b- Conidiomata

88c- Conidium

Fig. 89a-c: *Passalora* sp.2

89a- Leaf spots

89b- Conidiomata

89c- Conidium

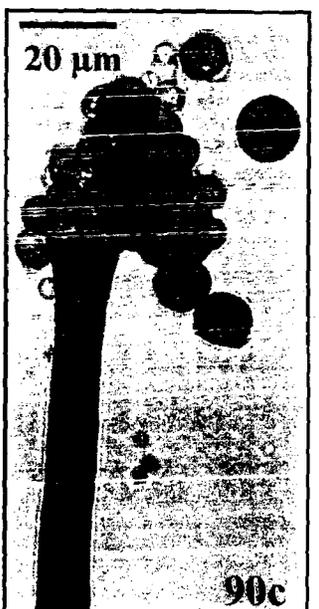
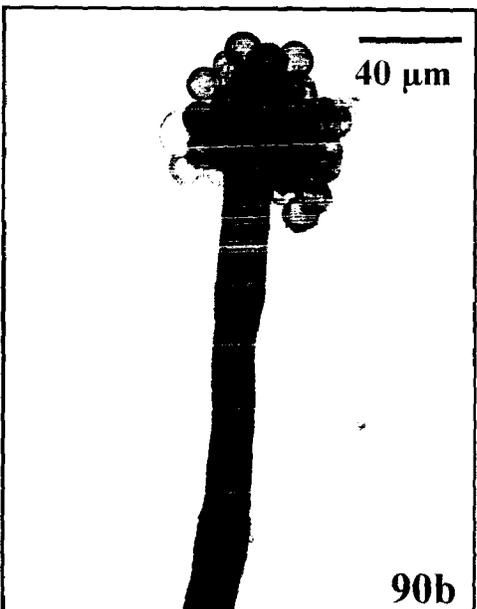
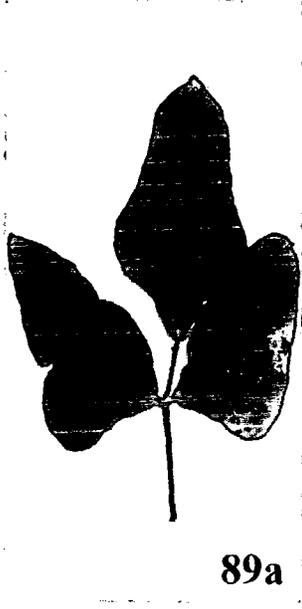
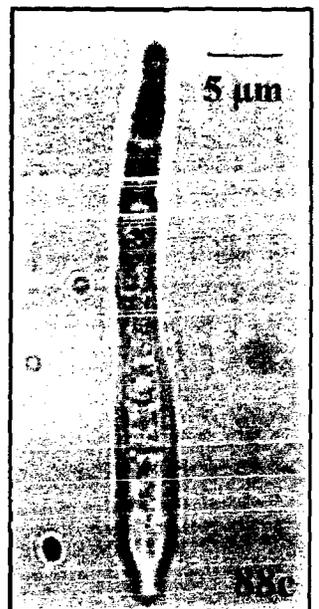
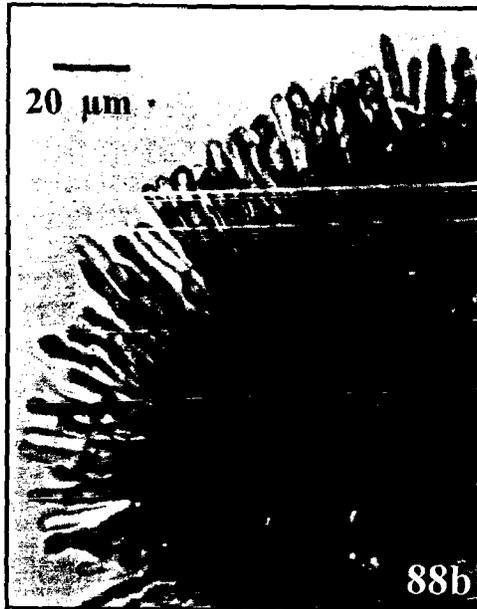
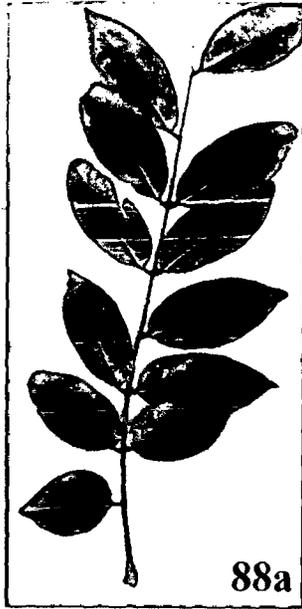
Fig. 90a-c: *Periconia byssoides*

90a- Leaf spots

90b- Conidiomata

90c- Conidiophore with conidia

Fig. 88-90



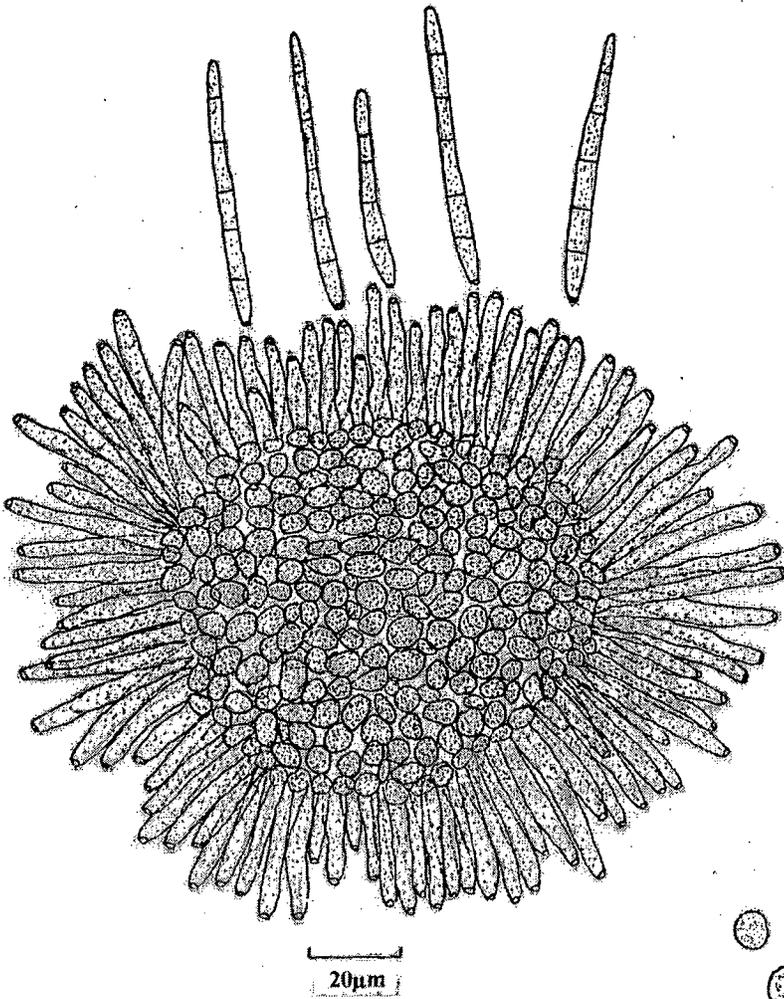


Fig. 88d *Passalora* sp.1

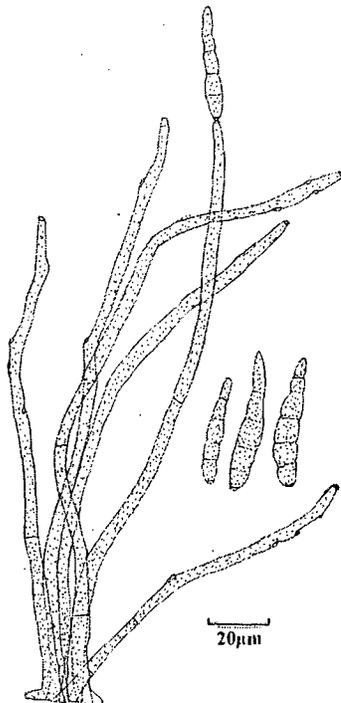


Fig. 89d *Passalora* sp.

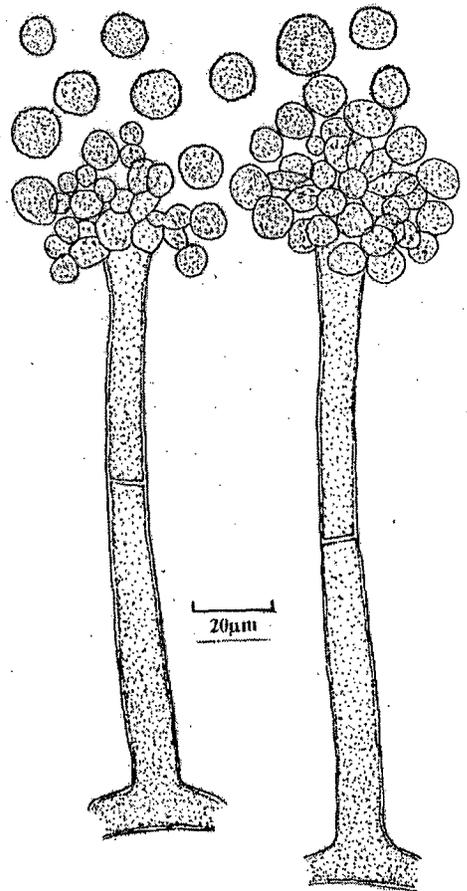


Fig. 90d *Periconia byssoides*

91. *Periconiella heveae* M.B. Ellis, 1967. *Mycol. Pap.* 111: 34 (Fig.91a-c; 91d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, semi-circular to irregular, 3-6 mm in wide, few spots were observed on some leaves of the tree. *Colonies* on leaf spots effuse, grey, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, septate, branched, sub-hyaline, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, hyaline, erect, straight to slightly flexuous, smooth, branched at the tip, septate, 290-425 x 4-6 μm . *Conidiogenous cells* polyblastic, terminal, discrete, cicatrized with numerous scars. *Conidia* solitary, simple, acropleurogenous, sub-hyaline, 1-3 - septate, 14-27 x 3-4 μm .

Specimen examined: On living leaves of *Calycopteris floribunda* Lamk. (Combretaceae), Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P195; Culture No. GUFCC No. 4922.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 5.9 cm in 7 days, circular, flat, off-white, margin smooth, reverse colourless.

Of the nearly 60 known species in the genus *Periconiella* Ellis, several have often been recorded as leaf inhabiting fungi (Ellis, 1971; 1976). *P. heveae* was isolated from two different places from the same host.

92. *Periconiella velutina* (G. Winter) Sacc., 1884. *Miscell. mycol.* 2: 17

(Fig.92a-c; 92d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to semi-circular, brown, spreading throughout the leaf surface, 5-10 mm in diam. *Colonies* on leaf spots effuse, hairy, dark brown. *Mycelium* partly immersed, partly superficial composed of composed of light olivaceous, thin walled, branched, septate, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores*

Fig. 91a-c: *Periconiella heveae*

91a- Leaf spots

91b- Conidiomata

91c- Conidiophore and conidium

Fig. 92a-c: *Periconiella velutina*

92a- Leaf spots

92b- Conidiomata

92c- Conidiophore with conidium

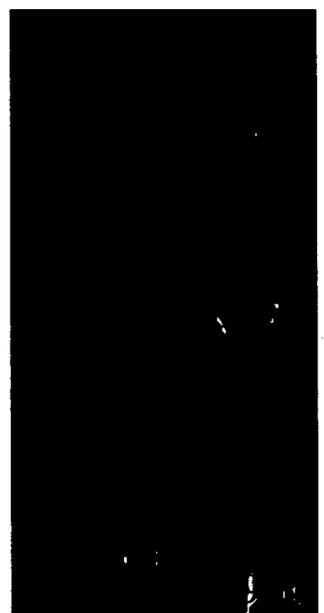
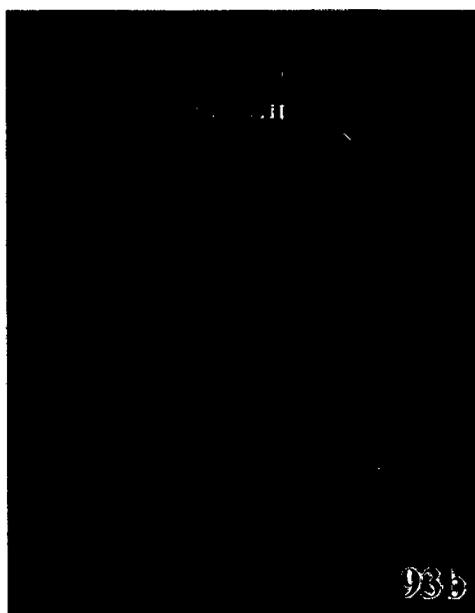
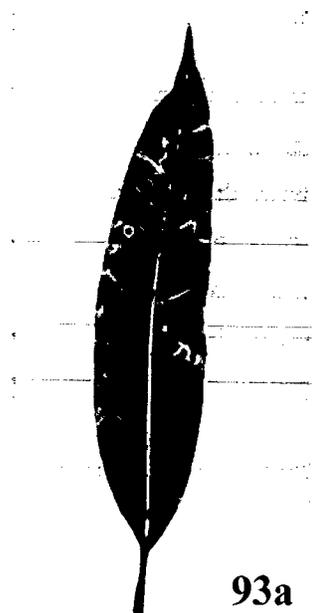
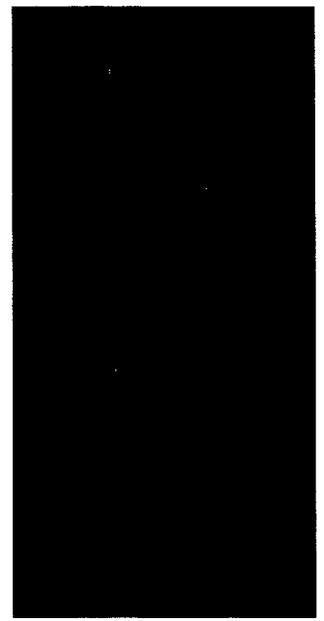
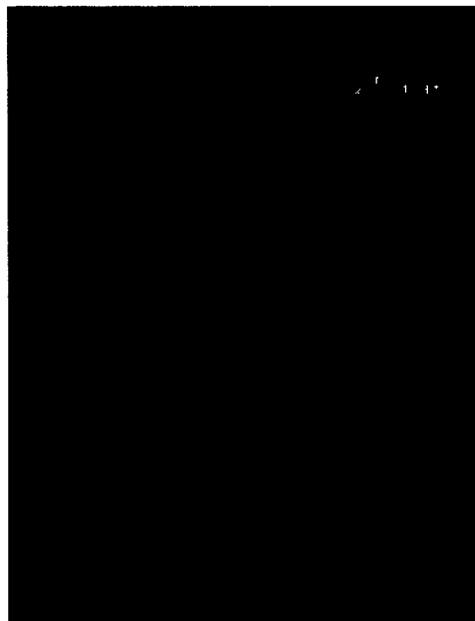
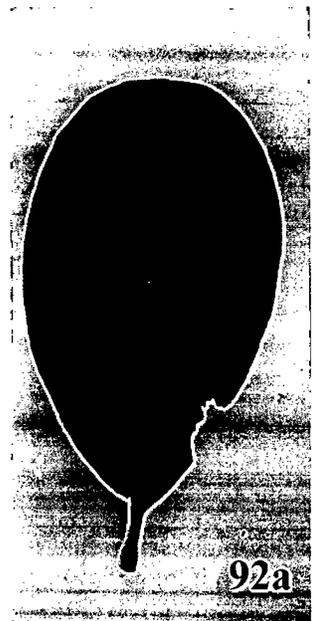
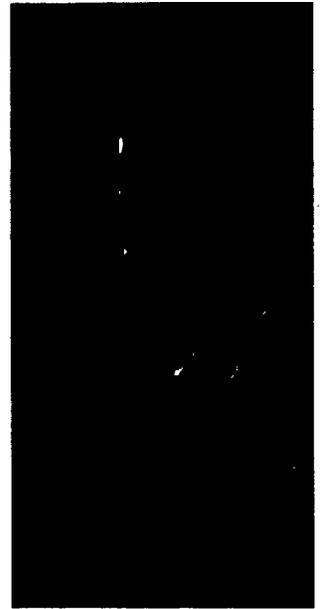
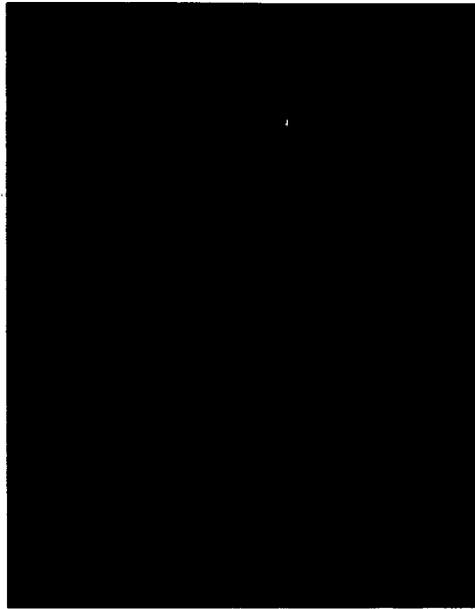
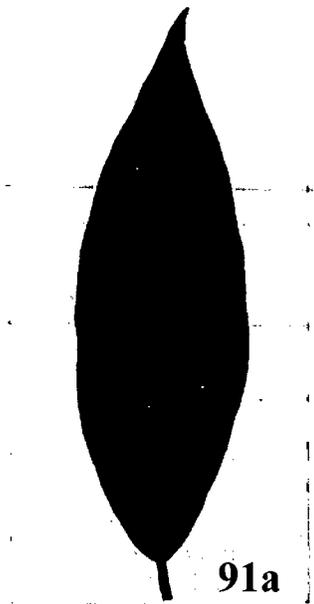
Fig. 93a-c: *Periconiella* sp. 1

93a- Leaf spots

93b- Conidiomata

93c- Conidiophore and conidium

Fig. 91-93



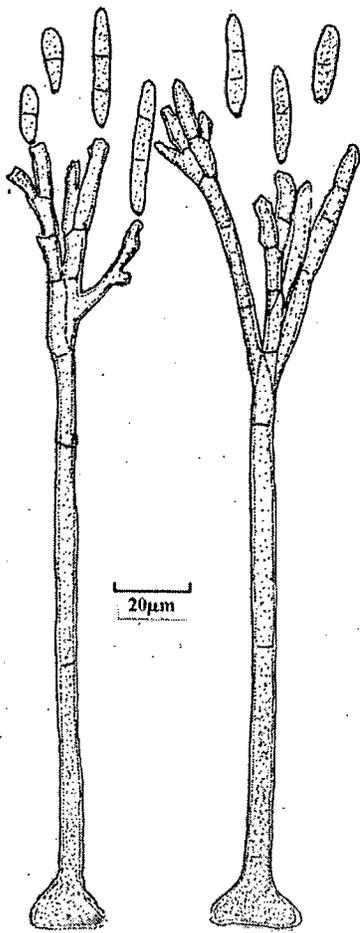


Fig. 91d *Periconiella heveae*

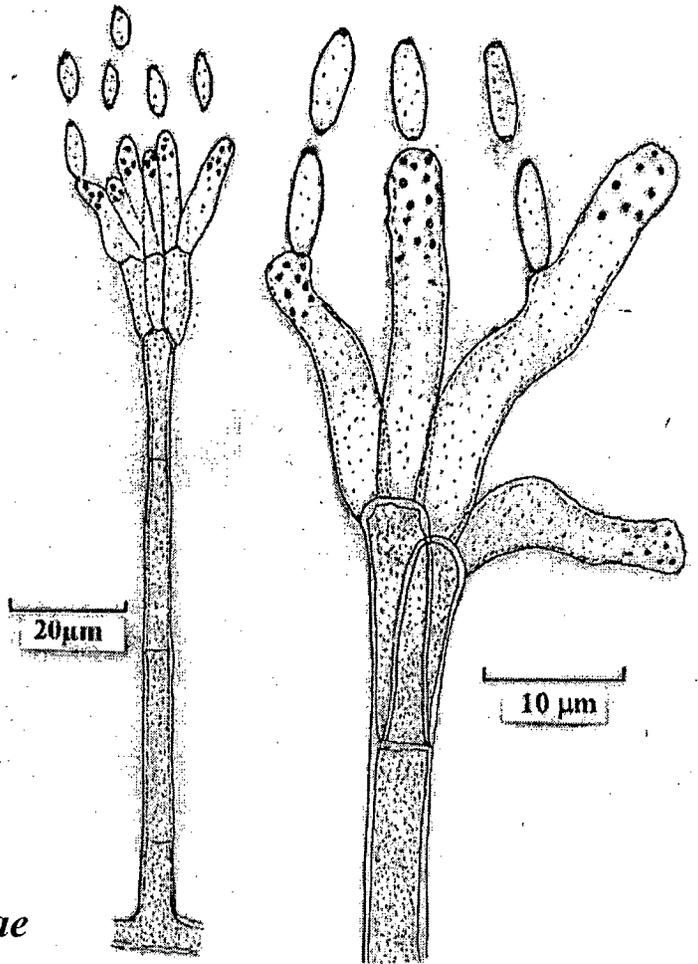


Fig. 92d *Periconiella velutina*

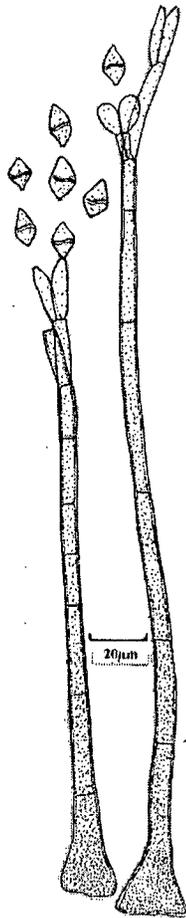


Fig. 93d *Periconiella* sp. 1

macronematous, mononematous, solitary, straight to flexuous, unbranched, septate, smooth, brown, thick walled, 300-360 x 3.5-7 µm. *Conidiogenous cells* polyblastic, integrated, terminal on stipe, determinate, cicatrized, scars numerous, 13.5-33.5 x 3-4.5 µm. *Conidia* catenate, dry, simple, light olivaceous, verrucose, aseptate, ellipsoidal, 8-11 x 3-4 µm.

Specimen examined: On living leaves of *Anacardium occidentale* Linn. (Anacardiaceae), Pilgao, Bicholim, Goa 10/03/03, Herb. No. GUBH P21; Banastari, Ponda Goa, 25/08/03, Pratibha, J., Herb. No. GUBH P21.

P. velutina, earlier known as litter fungus is now recorded here as a leaf inhabiting fungus.

93. *Periconiella* sp. 1

(Fig.93a-c; 93d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey, circular to semi-circular, 1-5 mm in diam., only one or two spots were observed on each leaf. *Colonies* on leaf spots effuse, hairy, brown. *Mycelium* partly immersed, partly superficial composed of light olivaceous, thin walled, branched, septate, 2-3.5 µm wide hyphae; *Stroma* none, *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, straight to flexuous, branched at the tip, septate, smooth, light yellow, thick walled, 170-360 x 4.5-7.5 µm. *Conidiogenous cells* polyblastic, terminal, determinate, integrated, cicatrized, scars numerous, 18.5-43.5 x 4-7 µm. *Conidia* solitary, simple, aseptate, smooth, hyaline, 9.5-11.5 x 7-9.5 µm, conidial scars darkened.

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Kesarwal, Goa, 12/07/03, Pratibha, J., Herb. No. GUBH P48.

94. *Periconiella* sp. 2

(Fig.94a-c; 94d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grayish to dark brown,

circular to irregular, 2-4 mm wide. *Colonies* on leaf spots effuse, grey, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, dark brown, erect, straight to slightly flexuous, smooth, forming complex branches at the tip, septate, thick-walled, brown, 150-320 x 3-4.5 μm . *Conidiogenous cells* polyblastic, terminal, discrete, determinate. *Conidia* solitary, dry, simple, acropleurogenous, sub-hyaline, smooth, rhomboidal, conico-truncate at the base, aseptate with a hyaline transverse band in the middle, 10-15 x 6-9 μm .

Specimen examined: On living leaves of *Nothopegia colebrookiana* (Wight) Blume, (Anacariaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P197; Culture No. GUFCC No. 4923.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 6.0 cm in 7 days, circular, cottony in the form of concentric rings, light green, margin serrated, reverse dark green.

95. *Periconiella* sp. 3

(Fig.95a-c; 95d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown, 3-4 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* partly immersed, partly superficial, composed of branched, septate, hyaline, smooth, 1.5-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, branched at the tip, septate, smooth, dark brown 140-307 x 5-9 μm . *Conidiogenous cells* polyblastic, terminal as well as intercalary, discrete, determinate, light olivaceous, cicatrized with numerous scars. *Conidia* solitary, simple, acropleurogenous, pale olivaceous, aseptate, smooth, pointed towards both the ends 13-23 x 4-7 μm .

Fig. 94a-c: *Periconiella* sp. 2

94a- Leaf spots

94b- Conidiomata

94c- Conidia

Fig. 95a-c: *Periconiella* sp. 3

95a- Leaf spots

95b- Conidiomata

95c- Conidia

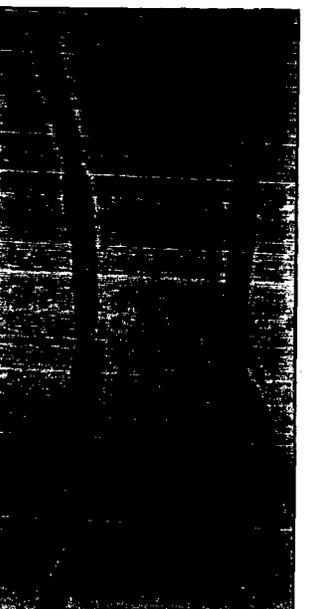
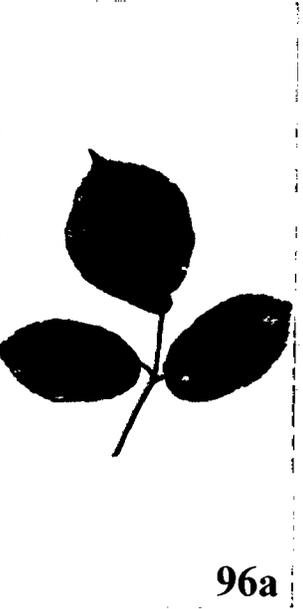
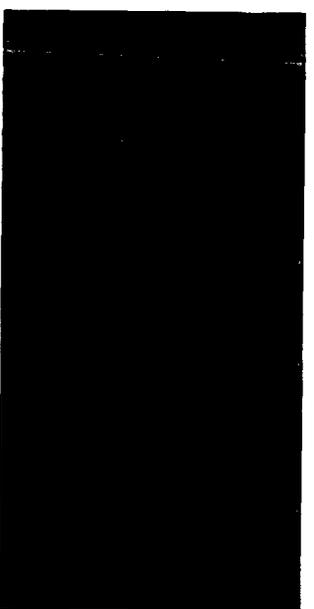
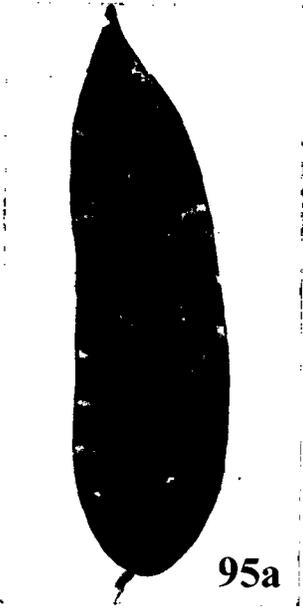
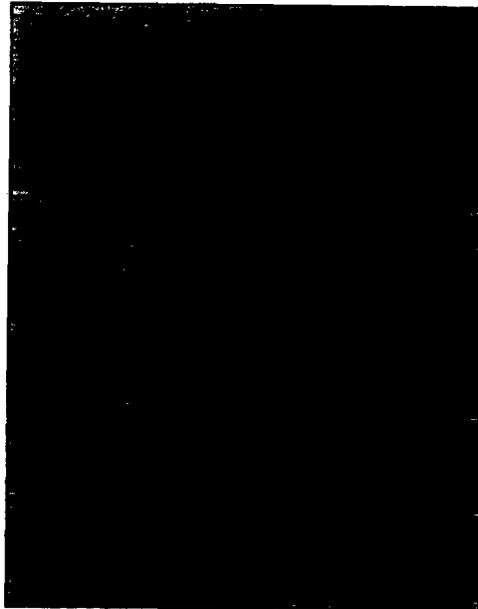
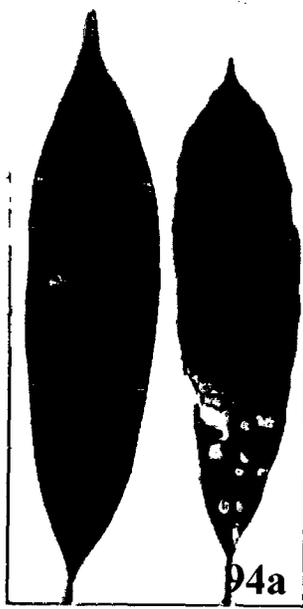
Fig. 96a-c: *Phaeoramularia leae*

96a- Leaf spots

96b- Conidiomata

96c- Conidia

Fig. 94-96



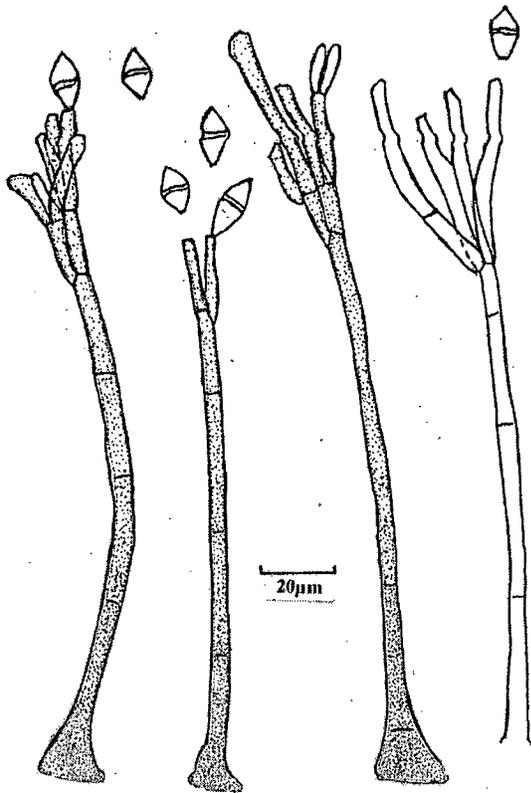


Fig. 94d *Periconiella* sp. 2

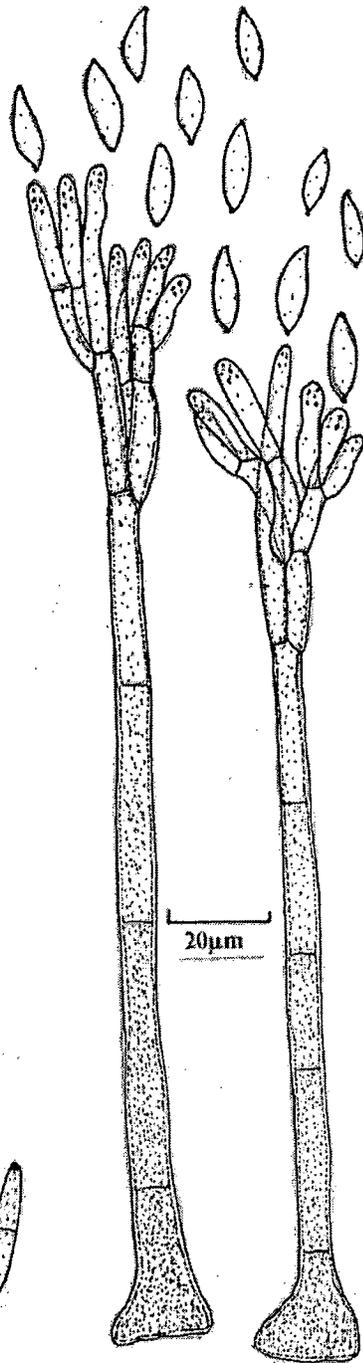


Fig. 95d *Periconiella* sp. 3

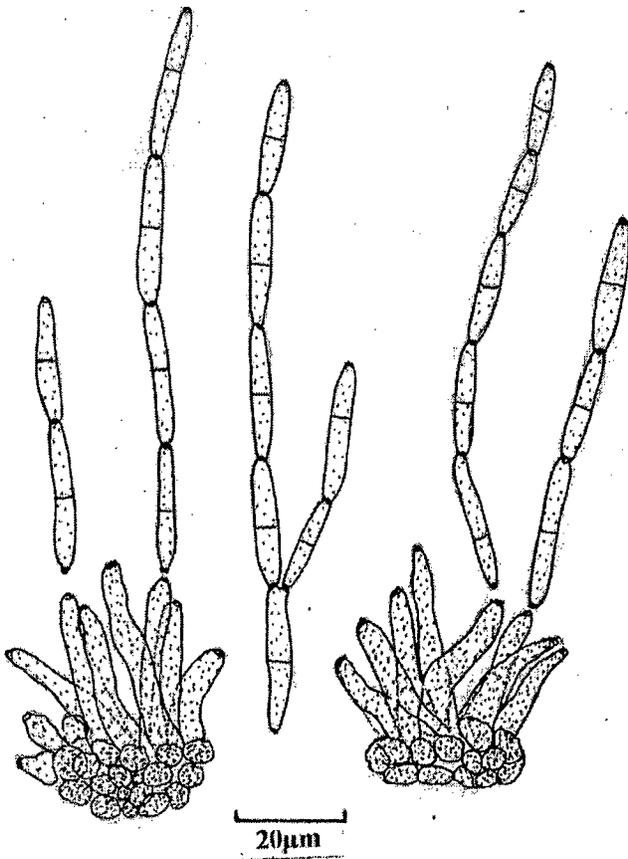


Fig. 96d *Phaeoramularia leae*

Specimen examined: On living leaves of *Hopea wightiana* Wall. (Dipterocarpaceae), Valpoi, Sattari Goa, 19/02/04, Pratibha, J., Herb. No. GUBH P121.

Sixty species of *Periconiella* have so far been recorded. Most of them were isolated from green leaves causing leaf spots (Ellis, 1971; 1976), whereas some were reported as litter fungi (Jacob, 2000). Above described 2 species of *Periconiella* are recorded as foliicolous.

96. *Phaeoramularia leae* (Chidd.) Deighton, 1976. In: Ellis, *More Dematiaceous Hyphomycetes* (Kew): 324 (Fig.96a-c; 96d)

Leaf spots amphigenous, light brown with dark brown margin, irregular, 15-17 mm wide, only one to two spots were observed on few leaves of the tree. *Colonies* on leaf spots effuse, brown, velvety. *Mycelium* immersed. *Stroma* pseudoparenchymatous, olivaceous brown, 30-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, unbranched, 0-2 septate, smooth, thick-walled, erect, straight to slightly flexuous, light olivaceous, 20-35 x 3-4.5 μm . *Conidiogenous cells* polyblastic, terminal, integrated, sympodial; conidial scars thickened. *Conidia* catenate, in branched chains, 2-3 septate, smooth, light olivaceous, cylindrical, apex sub-obtuse to rounded, base truncate, 17-32 x 2.5- 4 μm , with thickened and darkened hilum.

Specimen examined: On living leaves of *Leea* sp. (Leeaceae), Ambe Ghat, Canacona, Goa, 26/12/04, Pratibha, J., Herb. No. GUBH P184.

Only one species of *Phaeoramularia* Muntanola is known from the host genus *Leea*. Isolated species was assigned to *P. leae* in view of its similarities in shape and size of the conidiophores and conidia.

97. *Phaeotrichoconis* sp. (Fig.97a-c; 97d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown, 4-6

mm wide, only one or two spots were observed on each leaf. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary or in groups of 2-3, erect, straight to flexuous, brown, smooth, thick-walled, branched, septate, 100-177 x 5.5-9 μm . *Conidiogenous cells* polytretic, terminal and intercalary, determinate, integrated, sympodial, cicatrized, scars thickened and darkened, 18.5-33 x 5-8.5 μm . *Conidia* solitary, acropleurogenous, obclavate, rostrate, 5-6 septate light brown, thick-walled, smooth, 100-130 x 13-16 μm . beak hyaline smooth, thin-walled, 50-75 x 2-3 μm .

Specimen examined: On living leaves of *Ageratum conyzoides* Linn. (Asteraceae) Calem, Sanguem, Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P136.

A number of species are known in the genus *Phaeotrichoconis* Subramanian (Ellis, 1971, 1976). The above unidentified species is foliicolous in nature.

98. *Phalangispora* sp.

(Fig.98a-c; 98d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, forming irregular patch at the tip of leaf. *Colonies* on leaf spots effuse, gray. *Mycelium* immersed. *Setae* many, solitary, unbranched, smooth, erect, straight to slightly flexuous, dark brown to black, pointed at the tip, 140-190 x 3-5 μm . *Conidiomata* sporodochial; *sporodochia* develop on small stromatic base, hyaline, setose, with smooth, septate, unbranched, hyaline to pale olivaceous, 20-40 x 2-3 μm *conidiophores*. *Conidiogenous cells* monoblastic, integrated, terminal. *Conidia* solitary, 2-4 armed, smooth, sub-hyaline, 50-70 x 3-4 μm .

Specimen examined: On living leaves of *Holarrhena pubescens* Wall. ex G. Don (Apocynaceae), Molem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P77.

Species of the genus *Phalangispora* Nawawi & Webster are aquatic in habitat. The above unidentified species exhibits foliicolous nature.

99. *Pithomyces maydicus* (Sacc.) M. B. Ellis, 1960. *Mycol. Pap.* 76: 15

(Fig.99a-c; 99d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grey, circular to semicircular, sometimes irregular, 1-2 cm in diam., spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown to black. mycelium partly immersed, partly superficial, composed of smooth, branched, septate, light brown, 2-3.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. Conidiophores semi-macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, thick walled, branched, septate, brown, 5-13 x 2-4 μm . *Conidiogenous cells* monoblastic to polyblastic, integrated, terminal, pale brown, 6-10 x 1.5-3 μm . *Conidia* solitary, simple, broadly ellipsoidal, smooth, dark brown, rounded at both ends, 2-3 septate, often with one oblique septa, 13-22 x 6-13 μm .

Specimen examined: On living leaves of *Ficus benghalensis* Linn. (Moraceae), University Campus, Taleigao Goa, 25/01/03, Pratibha, J., Herb. No. GUBH P12; Culture No. GUFCC No. 4924.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 6.2 cm in 7 days, circular, cartilaginous, off-white with dark brown spore mass, margin serrated, reverse colourless.

Several species of *Pithomyces* Berkeley & Broome, are reported till date and found associated with decaying litter, soil, air and green leaves as epiphytes as well as endophytes (Ellis, 1971, 1975; Matsushima, 1975; Jacob, 2000). *P. maydicus* has been isolated as foliicolous.

Fig. 97a-c: *Phaeotrichoconis* sp.

97a- Leaf spots

97b- Conidiomata

97c- Conidium

Fig. 98a-c: *Phalangispora* sp.

98a- Leaf spots

98b- Conidiomata

98c- Conidium

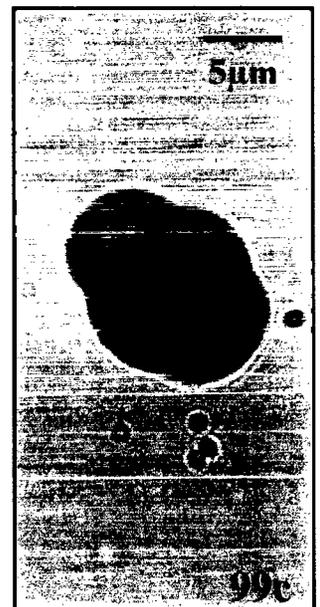
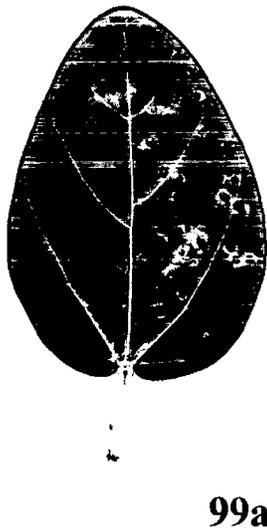
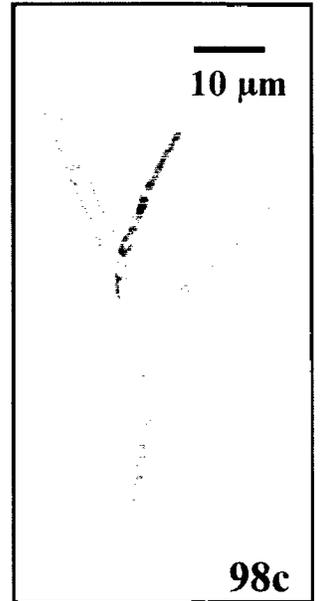
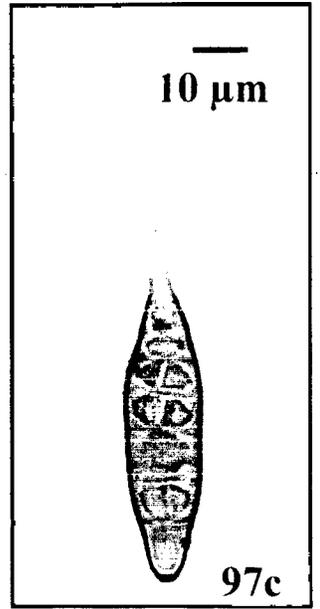
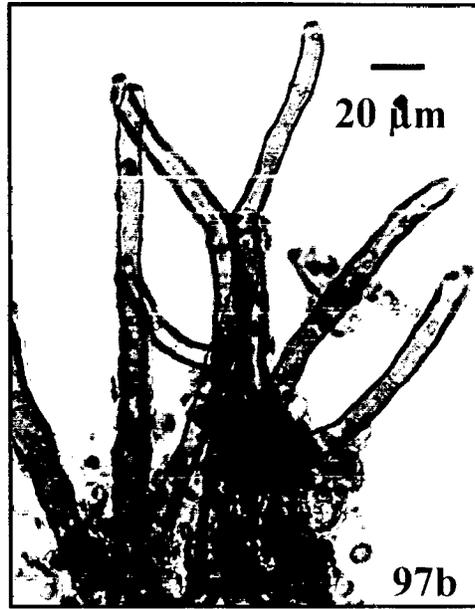
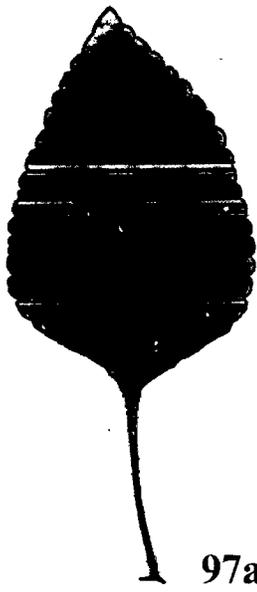
Fig. 99a-c: *Pithomyces maydicus*

99a- Leaf spots

99b- Conidiomata

99c- Conidium

Fig. 97-99



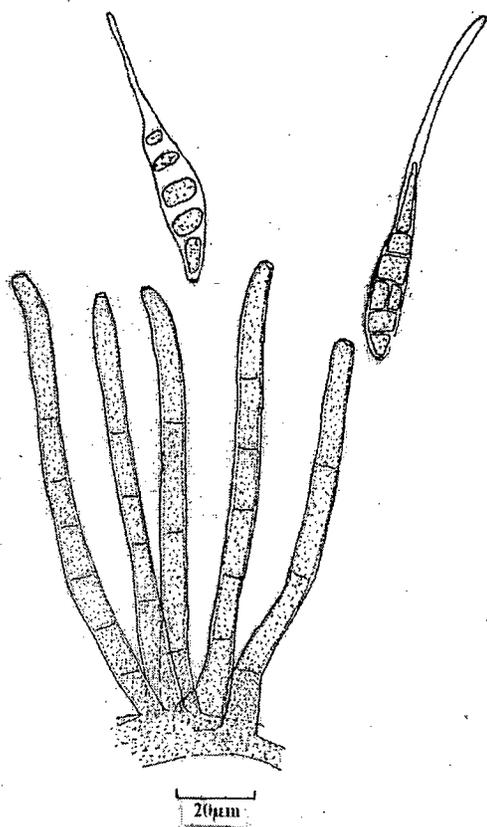


Fig. 97d *Phaeotrichoconis* sp.

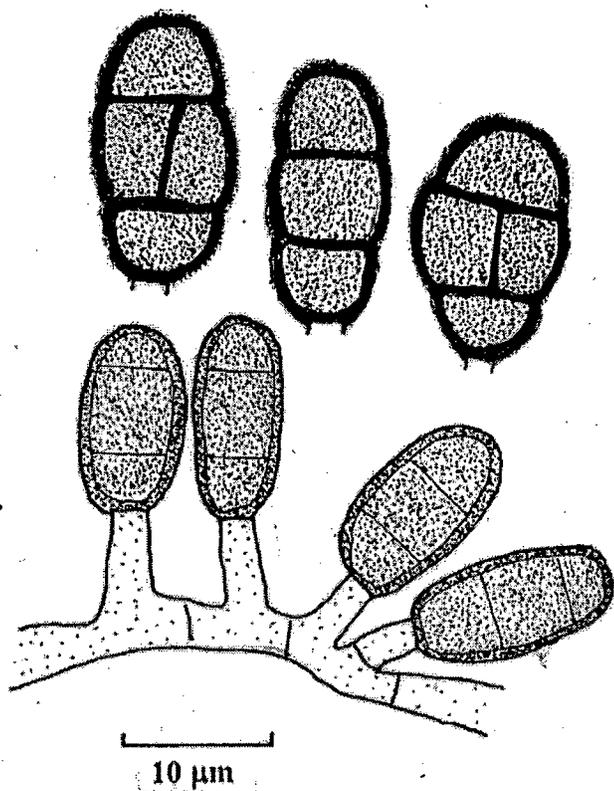


Fig. 99d *Pithomyces maydicus*



Fig. 98d *Phalangispora* sp.

100. *Pithomyces* sp.**(Fig.100a-c; 100d)**

Fungus Hyphomycete. *Leaf spots* amphigenous, gray, circular, 1-2 mm wide, the spots later collapses leaving the shot holes, spreading on entire leaf surface and almost all the leaves in the field showed infection. *Colonies* on leaf spots effuse, brown. *Mycelium* partly immersed, partly superficial, composed of thin, branched, septate, hyaline, 2.5-3.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* micronematous, mononematous, straight to flexuous, smooth, unbranched, septate, light brown, 3.5-8.5 x 2.5-4 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate, denticulate. *Conidia* solitary, simple, acrogenous, smooth, dark brown, ellipsoidal, rounded at both the ends, 1-2 septate, 9-20 x 4.5-7.5 μm .

Specimen examined: On living leaves of *Vigna* sp. (Fabaceae), GU Campus, Tiswadi Goa, 22/09/03, Puja G., Herb. No. GUBH P92; Culture No. GUFCC No. 4925.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 5.1 cm in 7 days, circular, flat, slimy, off-white, margin smooth, reverse colourless.

Species of *Pithomyces* were associated with decaying litter, soil, air and green leaves (Ellis, 1971, 1975; Matsushima, 1975; Jacob, 2000). The above species was isolated as foliicolous.

101. *Pseudocercospora abelmoschi* (Ellis & Everh.) Deighton, 1976. *Mycol. Pap.***140: 138****(Fig.101a-c; 101d)**

Fungus Hyphomycete. *Leaf spots* hypogenous, dark brown, irregular, 2-4 mm in diameter, spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, slender, thin walled, smooth, pale olivaceous, branched, 2-3.5 μm wide hyphae;

Stroma poorly developed, light brown. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, cylindrical, light olivaceous, 50-129 x 4-6.5 µm. *Conidiogenous cells* polyblastic, terminal, integrated, determinate, denticulate, sympodial, 18.5-27.5 x 4-6 µm, conidial scars unthickened and not darkened. *Conidia* solitary, simple, dry, acropleurogenous, light olivaceous, pluriseptate, apex sub-acute to obtuse, base truncate, smooth, straight, 22.5-55.5 x 3.5-4.5 µm, hilum unthickened, not darkened.

Specimen examined: On living leaves of *Abelmoschus esculents* Linn. (Malvaceae), Corjuvem, Bardez Goa, 31/05/03, Herb. No. GUBH P35; Caranzalem, Tiswadi Goa, 08/06/03, Herb. No. GUBH P35; Calem, Sanguem Goa, 22/06/04, Herb. No. GUBH P35; Banastari, Ponda Goa, 28/06/04, Pratibha, J., Herb. No. GUBH P35; Culture No. GUFCC No. 4926.

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 0.7 cm in 7 days, irregular, cartilaginous, dark green, margin serrated, reverse black.

So far 4 species of *Pseudocercospora* Speg., viz. *P. abelmoschi*, *P. hibiscicannabini* (Ellis & Everh.) Deighton, *P. hibisci-mutabilis* (Sawada) Deighton and *P. hibiscina* Ellis & Everh.) Guo & Liu, were reported from the host genus *Hibiscus*. On comparison of morpho-taxonomic features, our isolate matched with *P. abelmoschi*.

102. *Pseudocercospora adinicola* (A.K. Kar & M. Mandal) Deighton, 1976. *Mycol. Pap.* 140: 138 (Fig.102a-c; 102d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown in the centre surrounded by grey spot with yellow halo, 2-5 mm in diam. spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* dark brown, parenchymatous, spherical, 30-45 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight, smooth,

Fig. 100a-c: *Pithomyces* sp.

100a- Leaf spots

100b- Conidiomata

100c- Conidiophore with conidia

Fig. 101a-c: *Pseudocercospora abelmoschi*

101a- Leaf spots

101b- Conidiomata

101c- Conidium

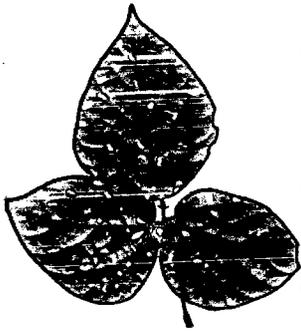
Fig. 102a-c: *Pseudocercospora adinicola*

102a- Leaf spots

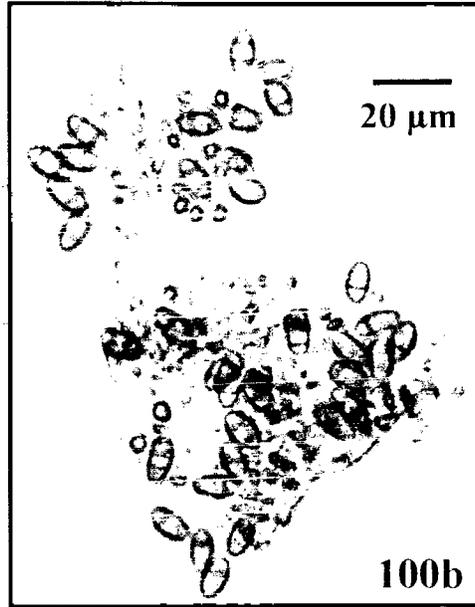
102b- Conidiomata

102c- Conidium

Fig. 100-102

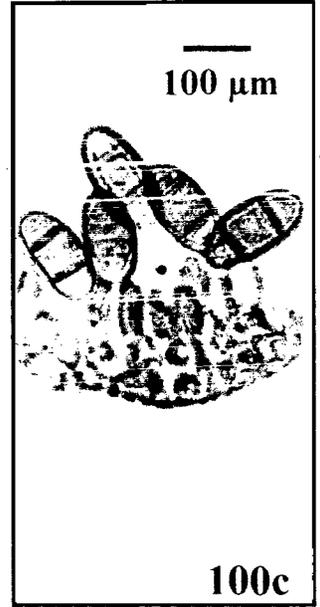


100a



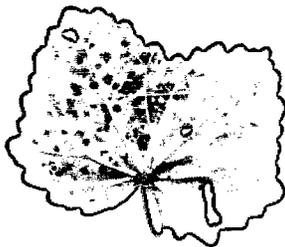
20 μ m

100b

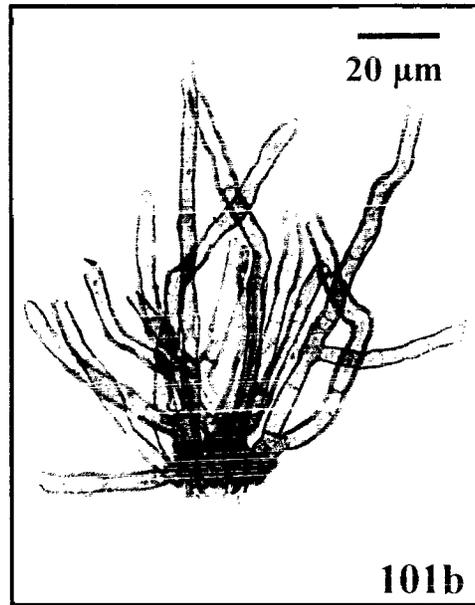


100 μ m

100c

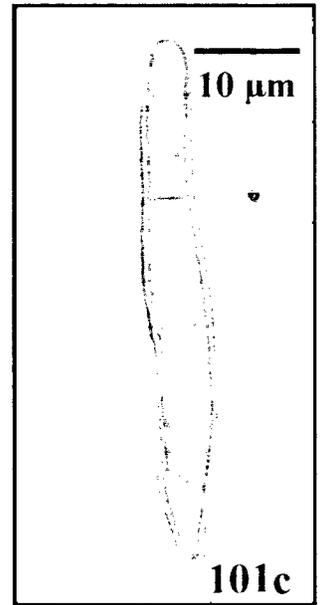


101a



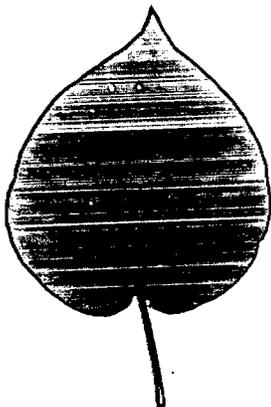
20 μ m

101b

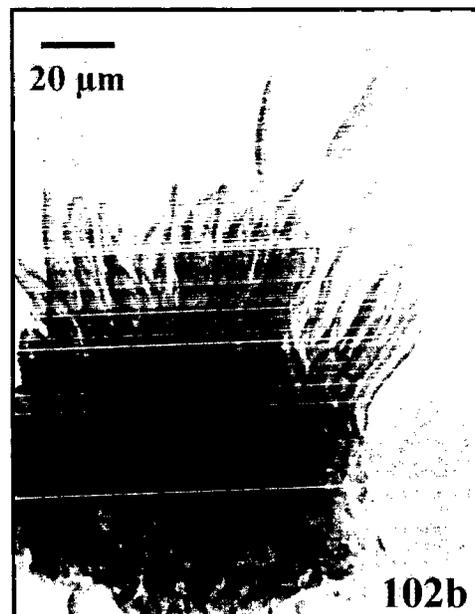


10 μ m

101c

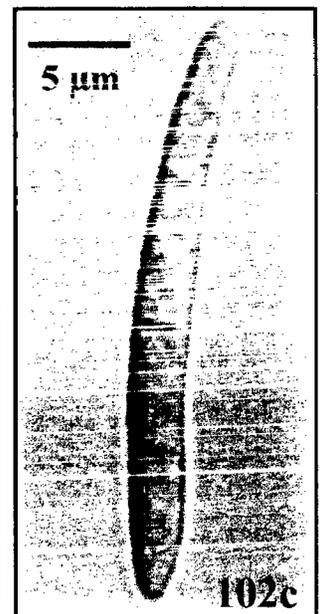


102a



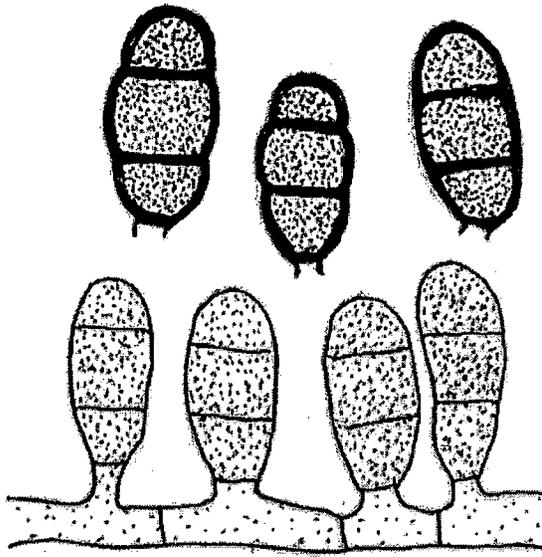
20 μ m

102b



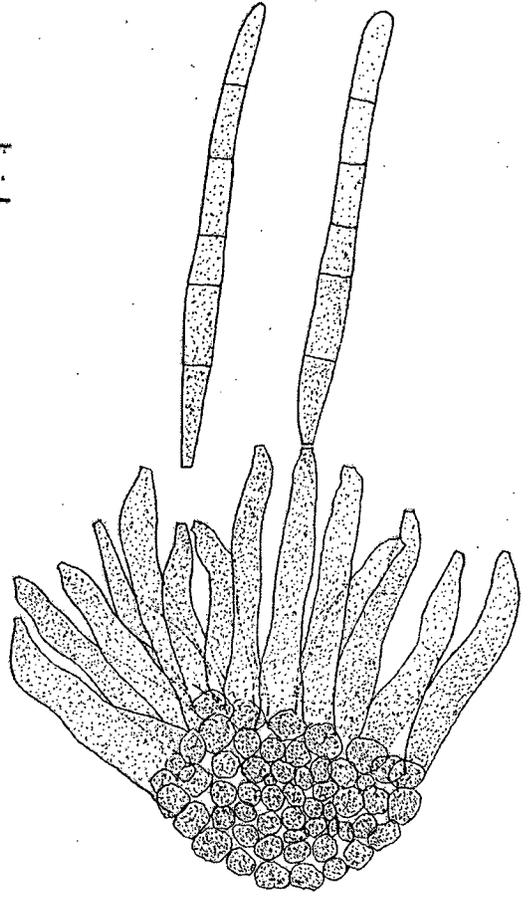
5 μ m

102c



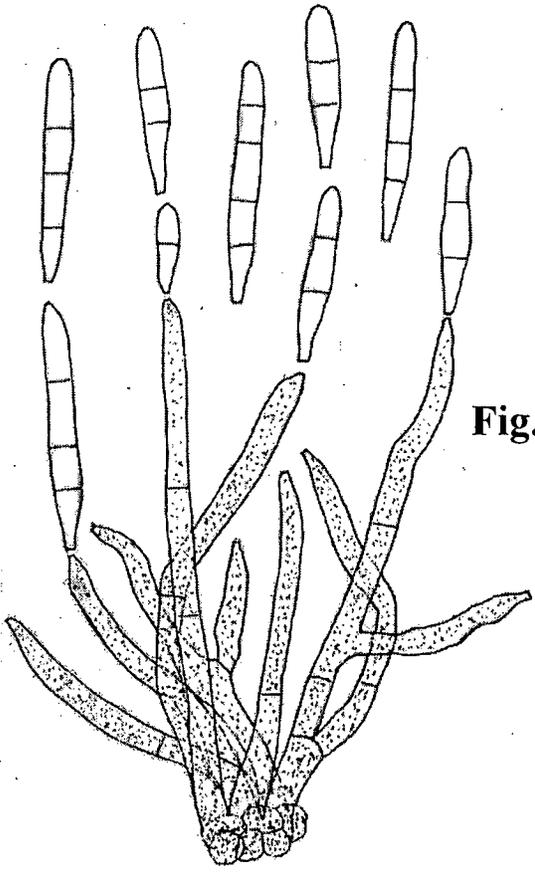
10 μm

Fig. 100d *Pithomyces* sp.



10 μm

Fig. 102d *Pseudocercospora adinicola*



20 μm

Fig. 101d *Pseudocercospora abelmoschi*

thick-walled, unbranched, 0-1 septate, olivaceous, 20-45.5 x 3-4.5 μm .
Conidiogenous cells monoblastic, terminal, determinate, integrated, denticulate, smooth. conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, sub-hyaline, pluriseptate, scolecosporous, smooth, straight, 33-100 x 2-3.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Adina cordifolia* Hook. (Rubiaceae), Bondla, Ponda, Goa, 26/09/04, Pratibha, J., Herb. No. GUBH P175.

Only one species of *Pseudocercospora* Speg., *P. adinicola*, is reported from the host genus *Adina*. Our isolate showed resemblance with *P. adinicola* with respect to morphology and dimension of conidiophores and conidia, except with little variation in the length of conidia. The fungus was isolated from 4 different localities on the same host, indicating its specificity to the host plant.

103. *Pseudocercospora anacardi* E. Castell. & Casulli, 1981. *Rivista di Agricoltura Subtropicale e Tropicale* 75(1): 103 **(Fig.103a-c; 103d)**

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, rectangular, 2-5 mm wide. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of hyaline, smooth, branched, septate, 2-3 μm wide hyphae; *Stroma* dark brown, pseudoparenchymatous, spherical, 20-27 μm in diam.; *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, sometimes geniculate, branched, septate, smooth, thick walled, pale brown, 60-130 x 3-5.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, sympodial, smooth, denticulate with unthickened not darkened conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, olivaceous brown, smooth, scolecosporous, acicular, pluriseptate, 40-130 x 3-4 μm .

Specimen examined: On living leaves of *Anacardium occidentale* Linn. (Anacardiaceae), Nanoda, Sattari, Goa, India, 21/01/05, Ashish, P., Herb. No. GUBH P219; Culture No. GUFCC No. 4927.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.3 cm in 7 days, irregular, cartilaginous, grayish-brown, margin serrated, reverse dark brown.

This is the second record of a species of *Pseudocercospora*, i.e. *P. anacardii*, on the host genus *Anacardium*.

104. *Pseudocercospora angulo-maculae* (A.K. Kar & M. Mandal) W.H. Hsieh & Goh, 1989. In: Goh & Hsieh, *Transactions of the Mycological Society of the Republic of China* 4(2-3): 42 (Fig.104a-c; 104d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* dark brown, parenchymatous, sub-spherical, 40-60 μm in diam.; *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, sometimes geniculate, unbranched, septate, smooth, thick walled, olivaceous brown, 20-65 x 3-4.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, sympodial, smooth, denticulate with unthickened not darkened conidial scars. *Conidia* solitary, simple, dry, acropleurogenous, olivaceous brown, smooth, scolecosporous, pluriseptate, 55-100 x 3-4 μm .

Specimen examined: On living leaves of *Ficus asperrima* Roxb. (Moraceae), Nanoda, Sattari, Goa, India, 21/01/05, Ashish, P., Herb. No. GUBH P217; Culture No. GUFCC No. 4928.

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 0.4 cm in 7 days, irregular, leathery, dark brown, margin serrated, reverse off-white.

So far 12 species of *Pseudocercospora* Speg., viz. *P. angulo-maculae*, *P. bolleana* (Thüm.) Sivan., *P. caudata* (Kranz) Braun, *P. cladophora* Sawada ex Goh & Hsieh, *P. fici* (Heald & Wolf) Liu & Guo, *P. fici-caricae* (Sawada) Goh & Hsieh, *P. fici-chartaceae* (Yen & Lim) Yen, *P. ficigena* U. Braun, *P. fici-religiosae* (Chidd.) Braun, Bagyan. & Jagad., *P. fici-septicae* Sawada ex Goh & Hsieh, *P. fici-sycamori* Crous & Braun and *P. kallarensis* (Ramakr. & Ramakr.) Guo & Liu, were reported on the host genus *Ficus*. Our isolate showed similarity with *P. angulo-maculae* with respect to length of the conidiophores and conidia.

105. *Pseudocercospora careyae* (T.S. Ramakr. & K. Ramakr.) R.K. Verma, M.K. Khan & Kamal, 1989. *Mycol. Res.* 92(3): 349 (Fig.105a-c; 105d)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, later turning dark brown to black, circular to irregular, 8-12 mm in diam, later spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed in the host tissue. *Stroma* dark yellow, spherical, 40-50 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, arising from stomata, in dense fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, olivaceous to light yellow 20-50 x 3-5 µm. *Conidiogenous cells* monoblastic, terminal, determinate, integrated, light olivaceous, smooth, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, pale olivaceous, pluriseptate, scolecosporous, acicular, smooth, straight, 20-87 x 2.5-4.5 µm, hilum unthickened, not darkened.

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Sawantwadi, Maharashtra, India, 29/11/03, Herb. No. GUBH P118; Banastari, Ponda Goa, 20/01/04, Herb. No. GUBH P118; Hankoni, Karnataka, India, 26/12/04, Herb. No. GUBH P118; Colem, Sanguem Goa, 16/01/05, Herb. No. GUBH P118; Bondla, Ponda Goa, 09/07/05, Pratibha, J., Herb. No. GUBH P118.

Fig. 103a-c: *Pseudocercospora anacardi*

103a- Leaf spots

103b- Conidiomata

103c- Conidium

Fig. 104a-c: *Pseudocercospora angulo-maculae*

104a- Leaf spots

104b- Conidiomata

104c- Conidium

Fig. 105a-c: *Pseudocercospora careyae*

105a- Leaf spots

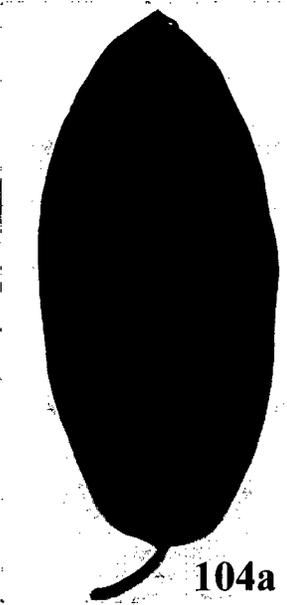
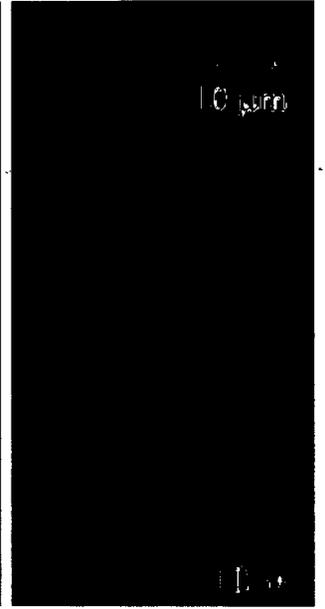
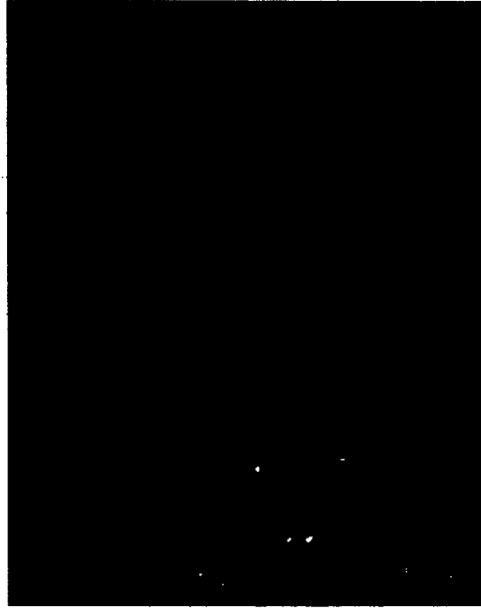
105b- Conidiomata

105c- Conidium

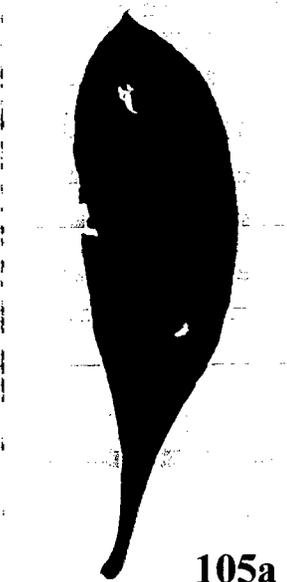
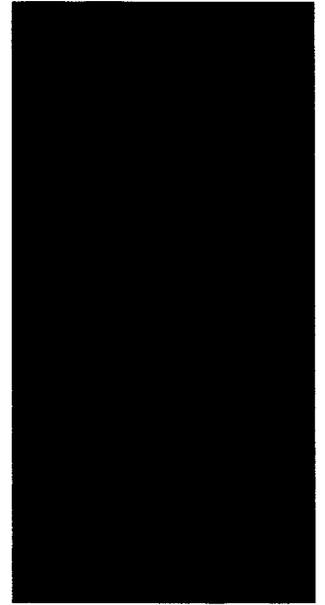
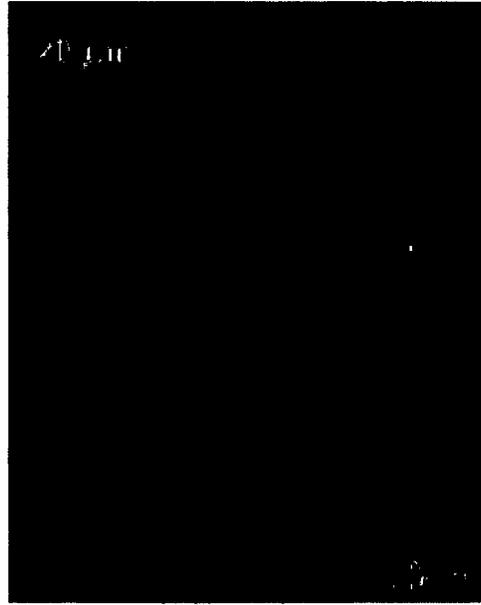
Fig. 103-105



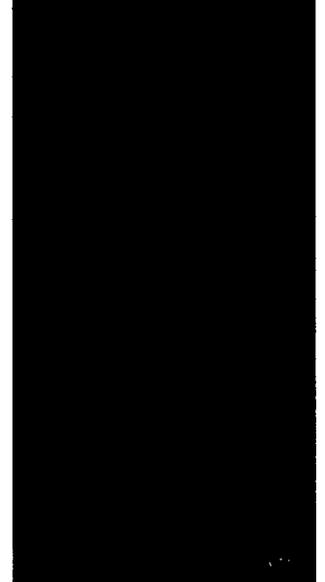
103a



104a



105a



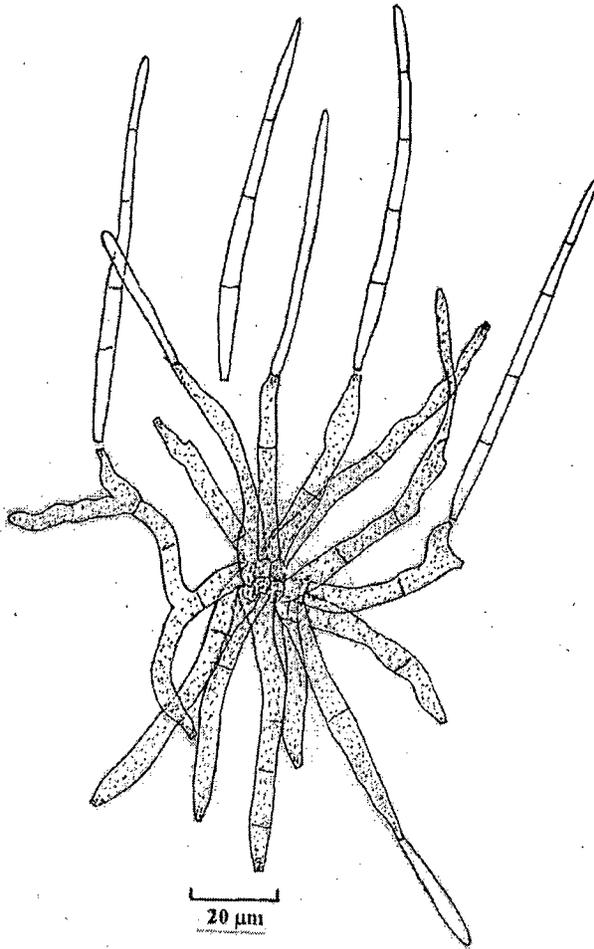


Fig. 103d *Pseudocercospora*
anacardi

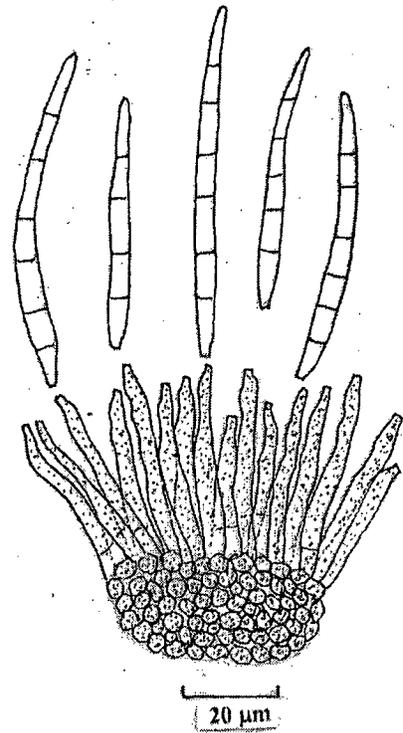


Fig. 104d *Pseudocercospora*
angulo-maculae

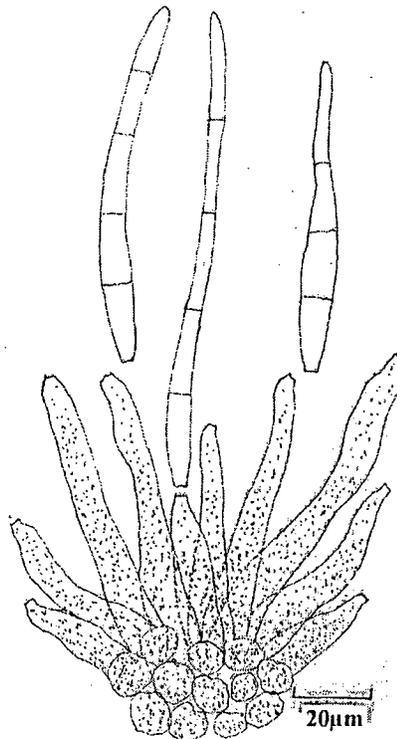


Fig. 105d *Pseudocercospora*
careyae

Only one species of *Pseudocercospora*, *P. careyae* has so far been recorded on the host genus *Careya*. Our collection resembled *P. careyae* with respect to its morphology and dimension of conidiophore and conidia. The fungus was isolated from 5 different localities on the same host.

106. *Pseudocercospora catappae* (Henn.) Y.L. Guo & X.J. Liu, 1989. *Mycosystema*.

2: 230

(Fig.106a-c; 106d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, reddish brown with distinct margin, spreading on entire leaf surface, mostly mature green leaves were infected, 5-11.5 mm wide. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed in the host tissue; *Stroma* brown, pseudoparenchymatous, 70-80 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, in small dense fascicles, very small, stumpy, arising from stroma, erumpent, erect, straight, unbranched, 0-1-septate, pale brown, 8.5-28 µm x 2-5.5 µm. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, denticulate, with unthickened, not darkened conidial scars. *Conidia* solitary, dry, simple, acrogenous, straight to slightly curved, smooth, 2-3 septate, hyaline, scolecosporous, sub cylindrical, acute at the apex, truncate at the base, hilum unthickened, not darkened, 30-96.5 µm long, 2.5-5 µm, wide at the broadest region, 1.5-2.5 µm at the tip.

Specimen examined: On living leaves of *Terminalia catappa* Linn. (Combretaceae), University Campus, Taleiga Goa, 01/01/03; Mashem, Canacona Goa, 16/10/04; Campal, Panjim Goa, 09/11/03, Pratibha, J., Herb. No. GUBH P2.

Seven species of *Pseudocercospora* Speg., viz. *P. arunjae* B. Sutton, *P. brevis* B. Sutton, *P. catappae* (Henn.) Guo & Liu, *P. chebulae* Sutton, *P. combretacearum* Sutton, *P. terminaliae* (Syd.) Ellis and *P. zambiensis* (Deighton) Sutton are reported from the host genus *Terminalia*. Our isolate showed similarity with *P. catappae* with

respect to shape and size of the conidiophore and conidia. The fungus was isolated from 3 different localities from the same host.

107. *Pseudocercospora corchorifoliae* (Thirum. & Govindu) Deighton, 1976. *Mycol. Pap.* 140: 120 (Fig.107a-c; 107d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, sometimes irregular, dark brown to black, 2-5 mm in diam, observed on entire leaf surface. *Colonies* on leaf spots effuse, dark green, hairy. *Mycelium* immersed. *Stroma* poorly developed, light brown. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, light brown, 17-35 x 2-4.5 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate, denticulate with unthickened and not darkened conidial scars. *Conidia* solitary, simple, dry, acrogenous, light olivaceous, pluriseptate, scolecosporous, filiform, smooth, straight, 35-90 x 2-5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Melochia corchorifolia* L. (Sterculiaceae), St. Estevam, Tiswadi, Goa, 19/07/03, Herb. No. GUBH P57; Banastari, Ponda Goa, 23/07/04, Herb. No. GUBH P57; University campus, Taleigao Goa, 21/07/05, Pratibha, J., Herb. No. GUBH P57.

So far 3 species of *Pseudocercospora* Speg., viz. *P. corchorifoliae*, *P. melochiae* (Henn.) Deighton and *P. melochiigena* Rao, Arch. Singh & Kamal *P. adinicola* were reported from the host genus *Melochia*. The isolated species showed similarities with *P. corchorifoliae* with respect to shape and size of conidiophore and conidia. The fungus was isolated from 3 different localities from the same host.

108. *Pseudocercospora crotalariana* (Pavgi & U.P. Singh) Deighton, 1976. *Mycol. Pap.* 140: 142 (Fig.108a-c; 108d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to semi-circular,

initially light brown, later turning to dark brown, 2-3 mm in diameter, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, slender, thin walled, smooth, pale olivaceous, branched, 2-3.5 μm wide hyphae; *Stroma* brown, pseudoparenchymatous, spherical, 20-30 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, arising from stomata in dense fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, light brown, 20-87.5 x 3-5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, denticulate, conidial scars unthickened and not darkened. *Conidia* solitary, simple, pale olivaceous, pluriseptate, rounded at the tip, flattened at the base, smooth, straight, 25.5-55.5 x 2-4.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Crotalaria striata* Dc. Prodr. (Fabaceae), Corjuvem, Bardez Goa, 31/05/03, Herb. No. GUBH P34; Caranzalem, Tiswadi Goa, 08/06/03, Herb. No. GUBH P34; Miramar, Panjim Goa, 15/08/03, Herb. No. GUBH P34; Banastari, Ponda Goa, 12/09/03, Pratibha, J., Herb. No. GUBH P34; Culture No. GUFCC No. 4929.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.3 cm in 7 days, irregular, cartilaginous, dark brown, margin serrated, reverse black.

Five species of *Pseudocercopora*, viz. *P. crotalariae* Hsieh and Goh, *P. crotalariae*, *P. crotalariicola* (Yen) Yen, *P. leguminum* (Chupp & Linder) Deighton and *P. luxurians* (Kar & Mandal) Deighton have been recorded so far on the host genus *Crotalaria*. The present collection showed similarity with *P. crotalariae* in view of morphology and dimension of conidiophores and conidia. The fungus was isolated from 4 different localities from the same host.

Fig. 106a-c: *Pseudocercospora catappae*

106a- Leaf spots

106b- Conidiomata

106c- Conidium

Fig. 107a-c: *Pseudocercospora corchorifoliae*

107a- Leaf spots

107b- Conidiomata

107c- Conidium

Fig. 108a-c: *Pseudocercospora crotalariana*

108a- Leaf spots

108b- Conidiomata

108c- Conidium

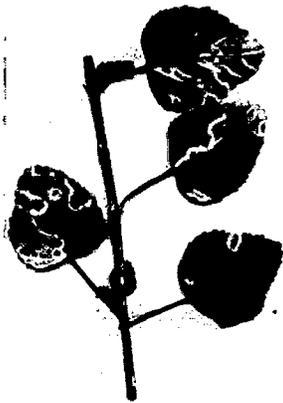
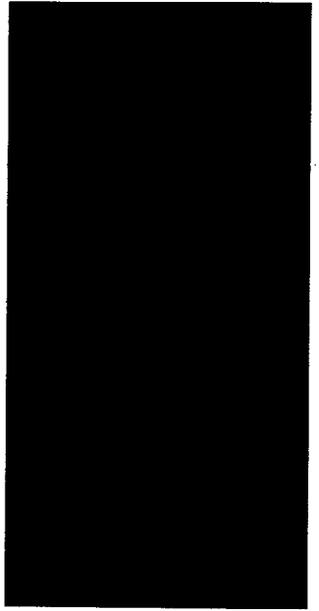
Fig. 106-108



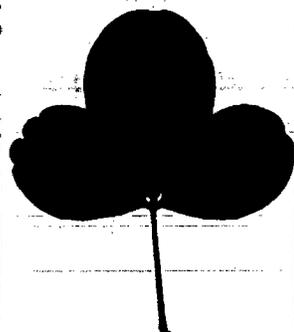
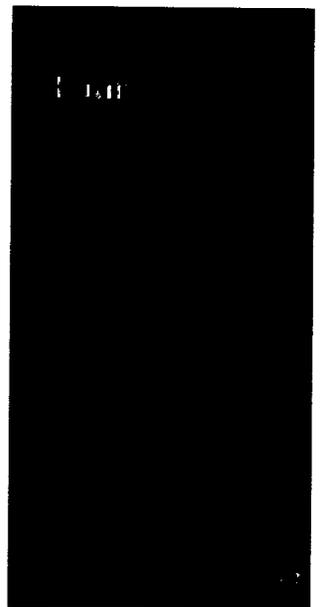
106a



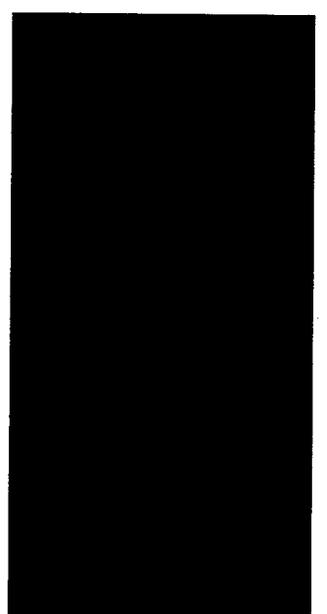
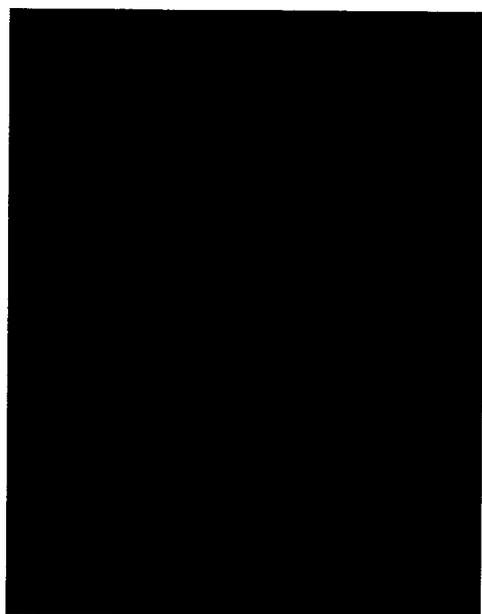
106b



107a



108a



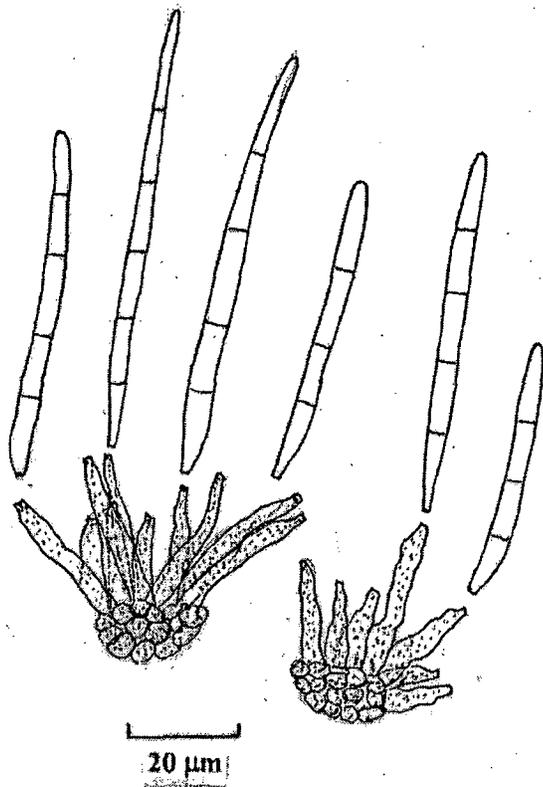


Fig. 107d *Pseudocercospora corchorifoliae*

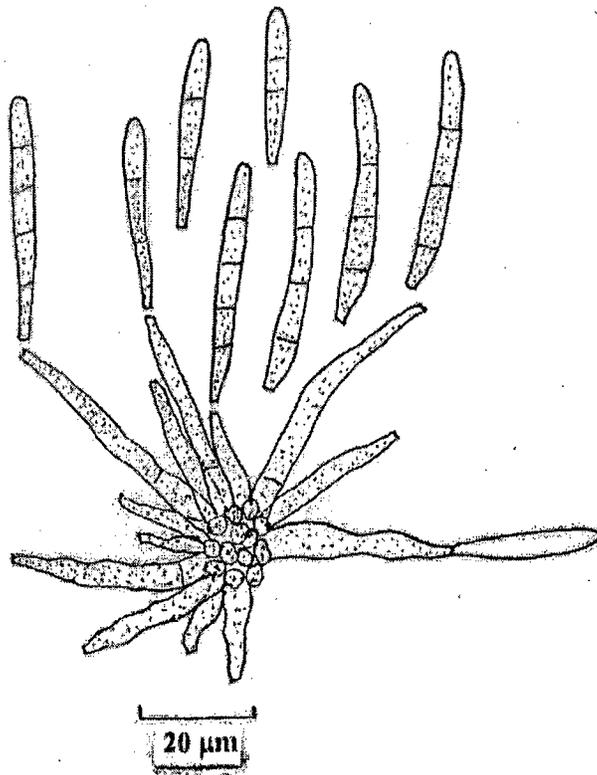


Fig. 108d *Pseudocercospora crotalariana*

109. *Pseudocercospora cruenta* (Sacc.) Deighton, 1976. *Mycol. Pap.* 140: 142

(Fig.109a-c; 109d)

Fungus Hyphomycete. *Leaf spots* amphigenous, gray, circular, minute, up to 1 mm in diam, spread over the entire surface of leaf. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, arising from stomata, in dense fascicles, erect, straight to slightly flexuous, unbranched, rarely branched, septate, smooth, pale brown, 30-60 x 3.5-4.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, denticulate, conidial scars unthickened and not darkened. *Conidia* solitary, simple, pale olivaceous, pluriseptate, tip sub-acute, base truncate, smooth, straight to slightly curved, 25-85 x 3-4.5 μm hilum unthickened, not darkened.

Specimen examined: On living leaves of *Vigna catjang* (Burm.) Walp. (Fabaceae) Corjuvem, Bardez Goa, 31/05/03, Pratibha, J., Herb. No. GUBH P33.

So far 7 species of *Pseudocercospora*, viz. *P. cruenta*, *P. dolichi* (Ellis & Everh.) Yen, *P. mungo* Deighton, *P. phaseolicola* Goh & Hsieh, *P. shihmenensis* (Yen) Yen, *P. vignae-reticulatae* Deighton and *P. vignigena* Yen, Kar & Das have been recorded on the host genus *Vigna*. Our isolate resembled *P. cruenta* with respect to shape and size of the conidia.

110. *Pseudocercospora fagarae* (W. Yamam.) Deighton, 1976. *Mycol. Pap.* 140: 144

(Fig.110a-c; 110d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, circular to semi-circular, 2-5 mm in diam. Spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Stroma* large, spherical to sub spherical, pseudoparenchymatous, dark brown, 65-130 μm . *Setae* and *hyphopodia* absent.

Conidiophores semi-macronematous, mononematous, fasciculate, light brown, erect, straight to flexuous, smooth, thick-walled, unbranched, septate, 18-45 x 2.5-3.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, denticulate, smooth. conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, light olivaceous, pluriseptate, scolecosporous, filiform, smooth, straight to slightly curved, 40-117 x 3.5-5.5 μm . newly formed conidia obovoid, 0-septate, 12.5-20.5 x 3-4.5 μm . hilum unthickened, not darkened.

Specimen examined: On living leaves of *Zanthoxylum rhetsa* (Roxb.) Dc. (Rutaceae), Polem, Canacona, Goa, 26/12/04, Pratibha, J., Herb. No. GUBH P179; Culture No. GUFCC No. 4930.

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 1.0 cm in 7 days, irregular, cartilagenous, dark green, margin serrated, reverse black.

Four species of *Pseudocercospora*, viz. *P. fagarae*, *P. fagaricola* Sawada ex Goh & Hsieh, *P. zanthoxyli* (Cooke) Guo & Liu and *P. zanthoxylicola* Crous & Braun, (2001) have so far been reported on the host genus *Zanthoxylum*. On comparison our isolated matched with *P. fagarae*.

111. *Pseudocercospora helleri* (Earle) Deighton, In: Ellis, 1976. *Mycol. Pap.* 140: 115 (Fig.111a-c; 111d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to almost black, irregular, spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark green, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, thick-walled, branched, septate, olivaceous brown, 80-250 x 3.5-5 μm . *Conidiogenous cells* monoblastic, rarely polyblastic, terminal and intercalary, determinate, integrated, denticulate, smooth. conidial scars unthickened, not darkened.

Fig. 109a-c: *Pseudocercospora cruenta*

109a- Leaf spots

109b- Conidiomata

109c- Conidium

Fig. 110a-c: *Pseudocercospora fagarae*

110a- Leaf spots

110b- Conidiomata

110c- Conidium

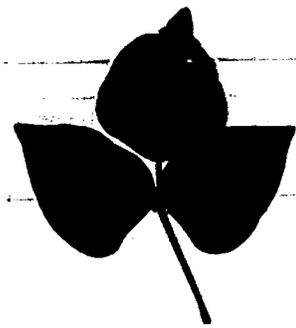
Fig. 111a-c: *Pseudocercospora helleri*

111a- Leaf spots

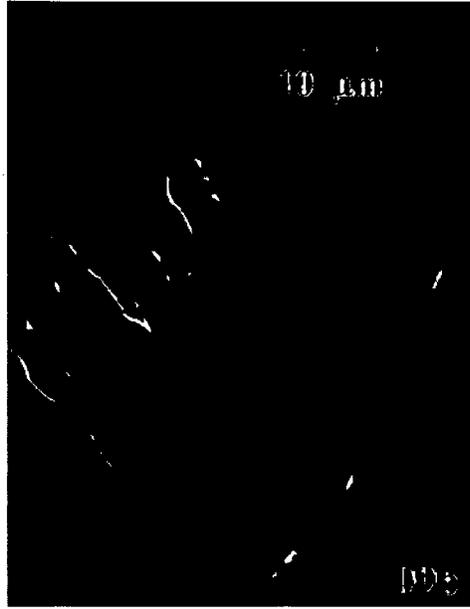
111b- Conidiomata

111c- Conidium

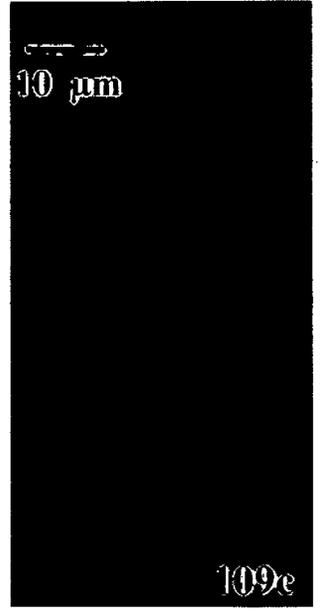
Fig. 109-111



109a



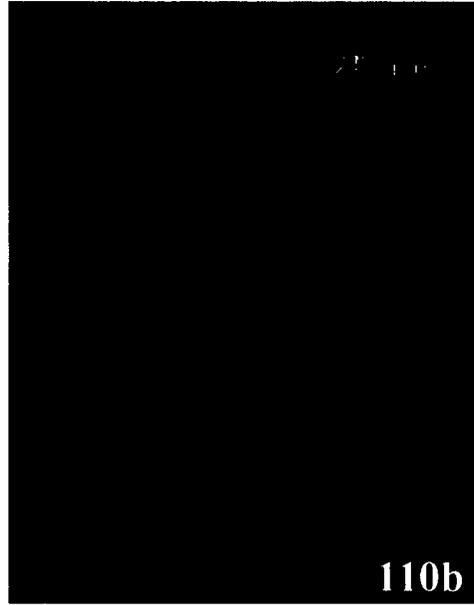
109b



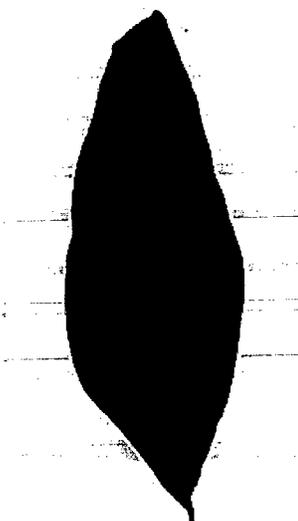
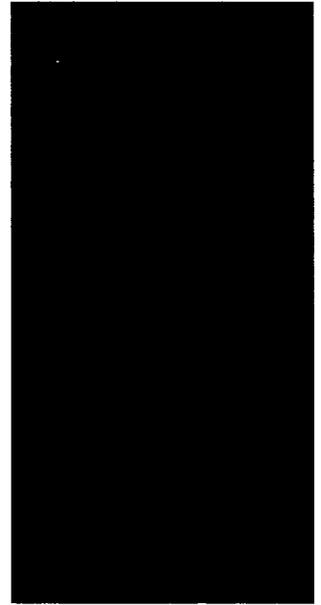
109c



110a



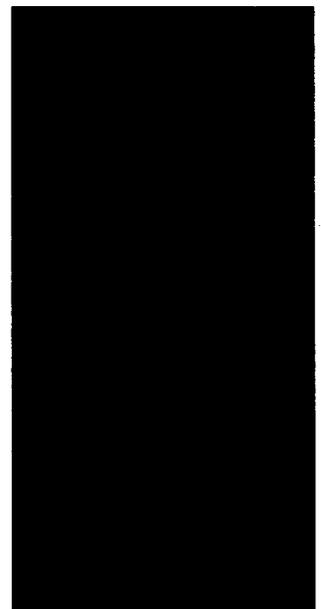
110b



111a



111b



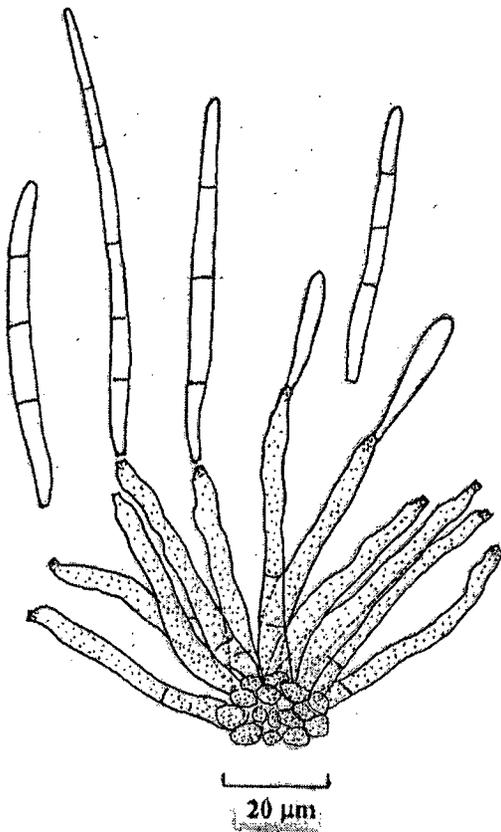


Fig. 109d *Pseudocercospora cruenta*

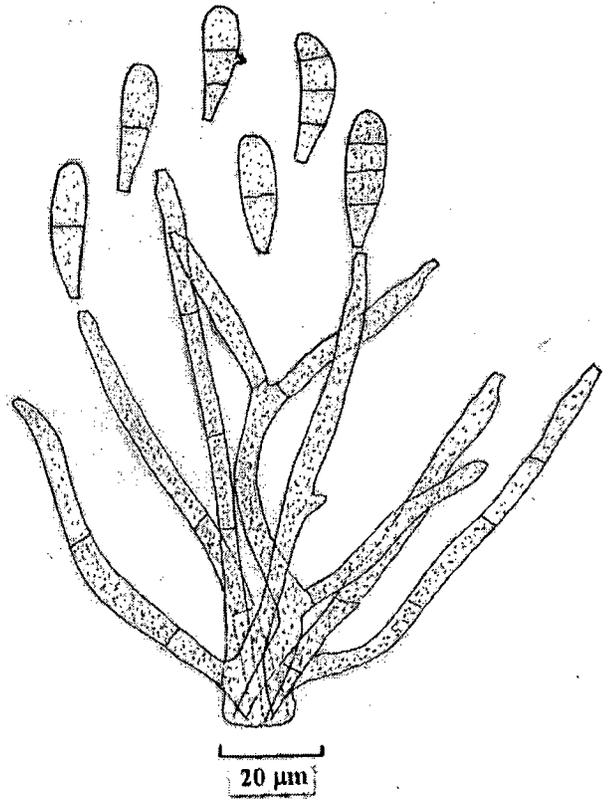


Fig. 111d *Pseudocercospora helleri*

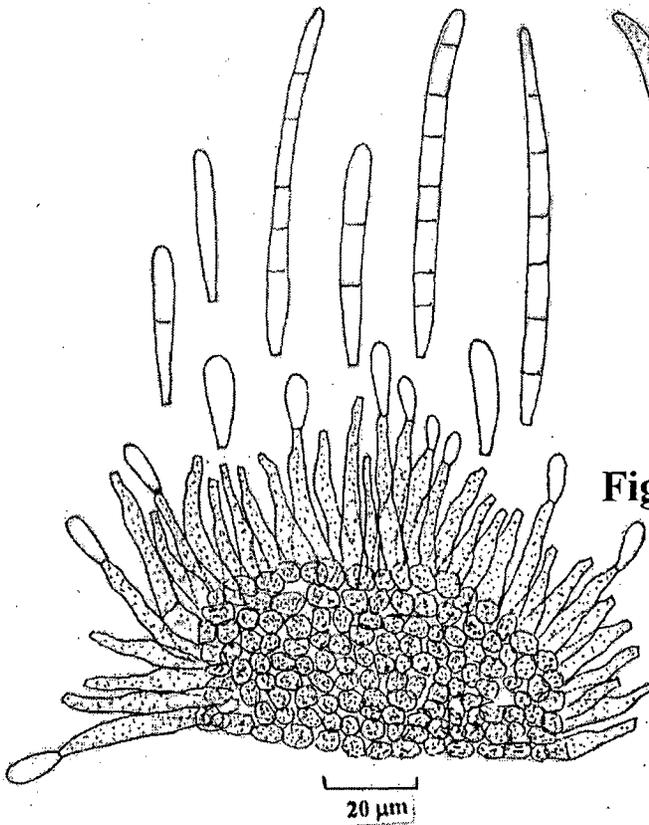


Fig. 110d *Pseudocercospora fagariae*

Conidia solitary, simple, acrogenous, light olivaceous, 0-3 septate, smooth, obovoid, rounded at the apex, truncate at the base, 20-35 x 6-9 μm ; hilum unthickened, not darkened.

Specimen examined: On living leaves of *Sphenoclea zeylanica* Gaertn. (Sphenocleaceae), St. Cruz., Tiswadi, Goa, 13/10/04; Pratibha, J., Herb. No. GUBH P176.

Pseudocercospora helleri is the only foliicolous species so far recorded on the host genus *Sphaenoclea*.

112. *Pseudocercospora holarrhenae* (Thirum. & Chupp) Deighton, 1976. *Mycol. Pap.* 140: 145 (Fig.112a-c; 112d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown to blackish, forming a patch covering half the surface of leaf with a distinct margin. *Colonies* on leaf spots effuse, dark brown. *Mycelium* partly immersed, partly superficial, composed of smooth, branched, septate, hyaline, 2-3.5 μm wide hyphae. *Stroma* parenchymatous, dark brown, 27-32.5 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, arising from stroma as well as superficial mycelium, conidiophores arising from stroma dense, fasciculate, erect, straight, smooth, pale brown, unbranched, mostly aseptate, sometimes 1-septate, 30-56.5 x 2.5-5 μm , conidiophores arising from superficial hyphae solitary, light brown, 30-40 x 2-4.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, sometimes intercalary, determinate, sympodial, denticulate, with thickened but not darkened scars. *Conidia* solitary, dry, simple, acropleurogenous, smooth, hyaline, scolecosporous, pluriseptate, sub-acute at the tip, truncate the base, hilum unthickened, not darkened, 25-120 x 2-4.5 μm .

Specimen examined: On living leaves of *Holarrhena pubescens* Wall. ex G. Don (Apocynaceae), Banastari, Ponda Goa, 01/01/03, Herb. No. GUBH P4;

Paryem, Sattari Goa, 02/07/04, Herb. No. GUBH P4; Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P4.

Pseudocercospora holarrhenae has been the only species recorded so far on *Holarrhena* as a foliicolous fungus. During the study period, the fungus was isolated from 3 different localities on the same host.

113. *Pseudocercospora jasminicola* A.S. Mull. & Chupp ex Deighton, 1976. *Mycol. Pap.* 140: 74 (Fig.113a-c; 113d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown in the centre with yellow halo, 2-3 mm in diam., spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* dark brown, spherical, pseudoparenchymatous, 40-50 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, light brown, erect, straight to slightly flexuous, unbranched, septate, smooth, 15-34 x 2-3.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, determinate, integrated, sympodial, denticulate, smooth, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, light olivaceous, pluriseptate, scolecosporous, acicular, smooth, straight, truncate at the base, pointed at the tip, 62.5-100 x 2-4 μm . hilum unthickened, not darkened.

Specimen examined: On living leaves of *Jasminum* sp. (Oleaceae), Curca, Tiswadi, Goa, 15/07/04, Dr. D.J. Bhat, Herb. No. GUBH P151.

Two species of *Pseudocercospora*, viz. *P. butleri* (Syd.) Braun and *P. jasminicola* Mull. & Chupp ex Deighton are so far recorded on the host genus *Jasminum*.

Fig. 112a-c: *Pseudocercospora holarrhenae*

112a- Leaf spots

112b- Conidiomata

112c- Conidia

Fig. 113a-c: *Pseudocercospora jasminicola*

113a- Leaf spots

113b- Conidiomata

113c- Conidium

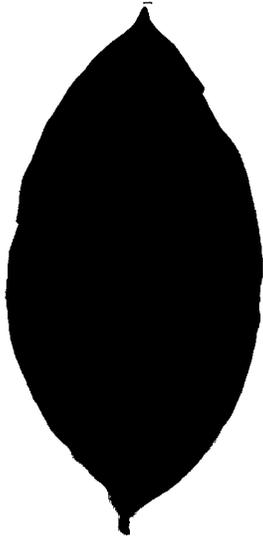
Fig. 114a-c: *Pseudocercospora maesae*

114a- Leaf spots

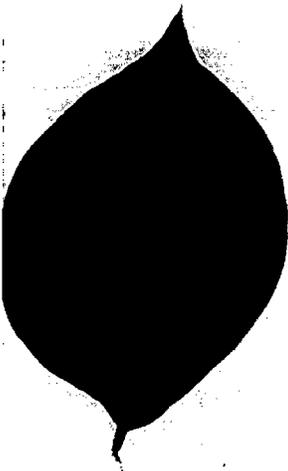
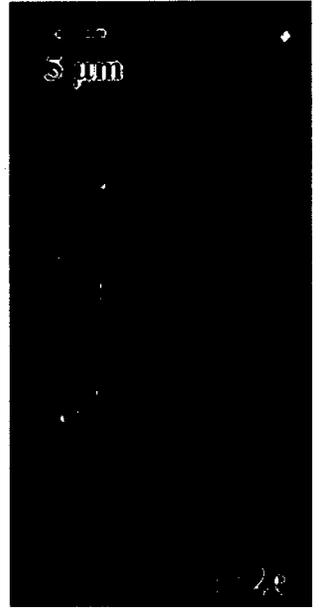
114b- Conidiomata

114c- Conidia

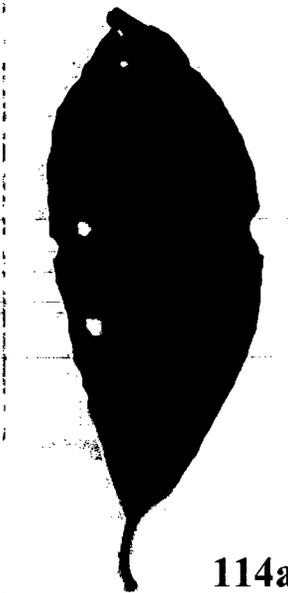
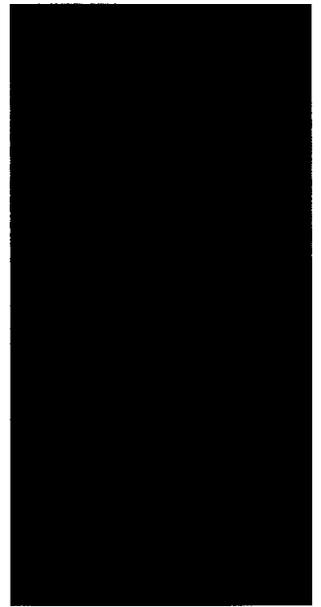
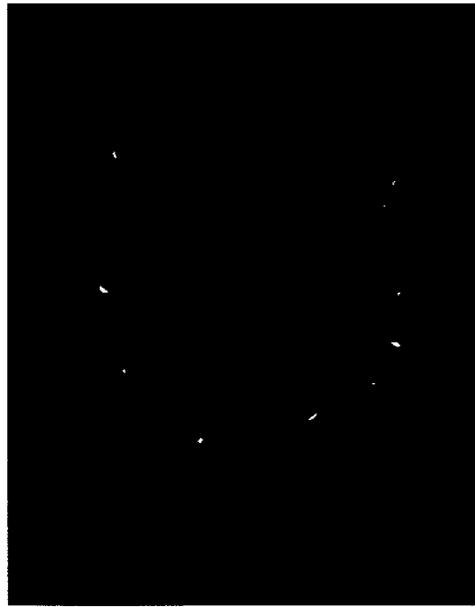
Fig. 112-114



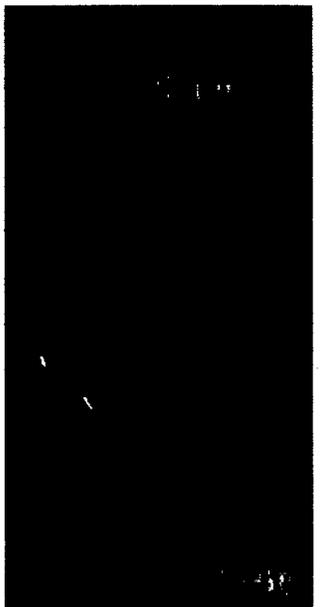
112a



113a



114a



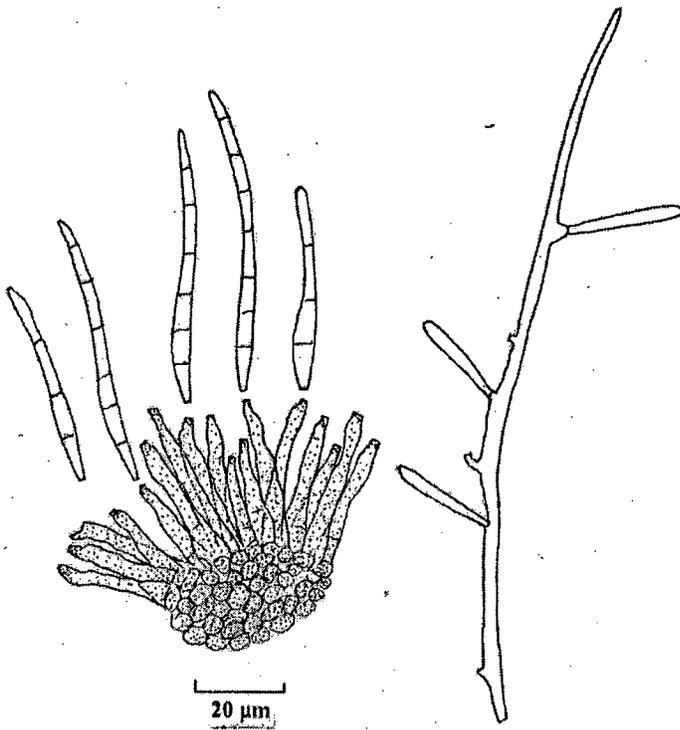


Fig. 112d *Pseudocercospora*
holarrhenae

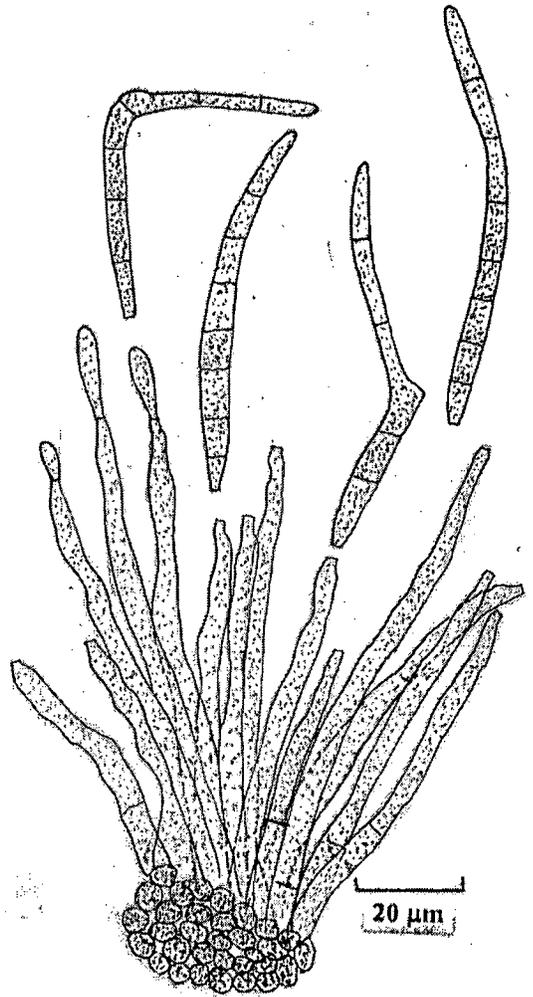


Fig. 114d *Pseudocercospora*
maesae

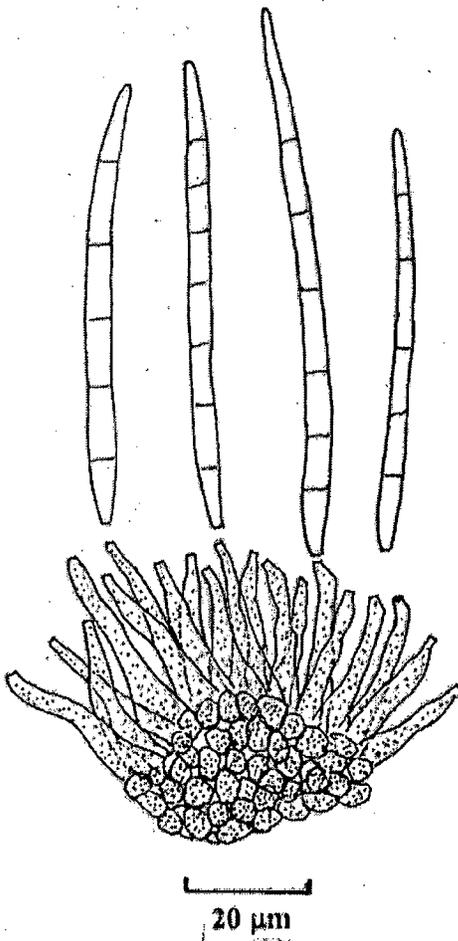


Fig. 113d *Pseudocercospora*
jasminicola

114. *Pseudocercospora maesae* (Hansf.) X.J. Liu & Y.L. Guo, 1992. *Acta Mycol. Sin.*

11(4): 295

(Fig.114a-c; 114d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown circular, sometimes irregular, 4-7 mm in diam. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, olivaceous brown, 90-130 x 3-4.5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, determinate, integrated, light brown, smooth, sympodial, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, olivaceous brown, pluriseptate, scolecosporous, smooth, straight to geniculate in the middle, 42-88 x 3-4.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Maesa indica* (Roxb.) Dc. (Myrsinaceae), Navelim, Murmugao, Goa, 04/09/04, Pratibha, J., Herb. No. GUBH P174.

Till date, only one species, *P. maesae* is recorded on the host genus *Maesa*.

115. *Pseudocercospora puderi* B.H. Davis ex Deighton, 1976. *Mycol. Pap.* 140: 90

(Fig.115a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, brown, 3-6 mm wide, few spots were observed on all the leaves of the plant. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* spherical, light brown, pseudoparenchymatous, 20-37 μm . *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, olivaceous brown, 15-30 x 2-3.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, light brown, smooth, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary,

simple, acrogenous, sub-hyaline, pluriseptate, scolecosporous, smooth, straight to slightly curved, 20-60 x 2-3.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Rosa* sp. (Rosaceae), Navelim, Murnugao, Goa, 04/09/04, Ashish, P., Herb. No. GUBH P171; Culture No. GUFCC No. 4931.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.7 cm in 7 days, circular, cartilagenous, dark green, margin smooth, reverse black.

Pseudocercospora puderi is the only species recorded so far on the host roses. Our isolate resembled the species with respect to morphology and dimension of the conidiophores and conidia.

116. *Pseudocercospora rhamnaceicola* Goh & W.H. Hsieh, 1990. In: Hsieh & Goh, *Cercospora and Similar Fungi from Taiwan* (Taipei): 274 (Fig.116a-c; 116d)

Fungus Hyphomycete. *Leaf spots* amphigenous, tiny, circular, grey to light brown with yellow halo, 2-3 mm in diam. *Colonies* on leaf spots effuse, brown. *Mycelium* partly immersed. *Stroma* poorly developed. *Setae* and *hyhopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, light olivaceous, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, septate, 20-45 x 2-4.5 μm . *Conidiogenous cells* polyblastic, terminal and intercalary, determinate, integrated, sympodial, denticulate; conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, light olivaceous, pluriseptate, scolecosporous, smooth, straight to slightly curved, with unthickened not darkened hilum, 30-95 x 2.5-4 μm .

Specimen examined: On living leaves of *Ziziphus oenoplia* (Linn.) Mill. (Rhamnaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Herb. No. GUBH P99; Banastari, Ponda Goa, 20/10/03, Herb. No. GUBH P99; Mashem, Cancona Goa, 16/10/04, Pratibha, J., Herb. No. GUBH P99.

Fig. 115a-c: *Pseudocercospora puderi*

115a- Leaf spots

115b- Conidiomata

115c- Conidium

Fig. 116a-c: *Pseudocercospora rhamnaceicola*

116a- Leaf spots

116b- Conidiomata

116c- Conidium

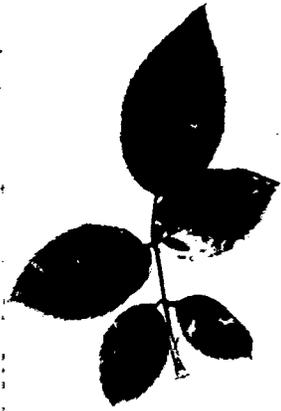
Fig. 117a-c: *Pseudocercospora stahlia*

117a- Leaf spots

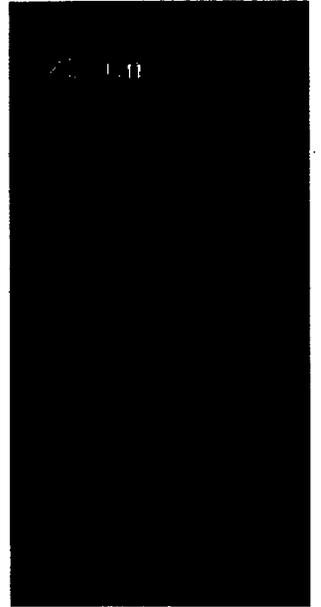
117b- Conidiomata

117c- Conidium

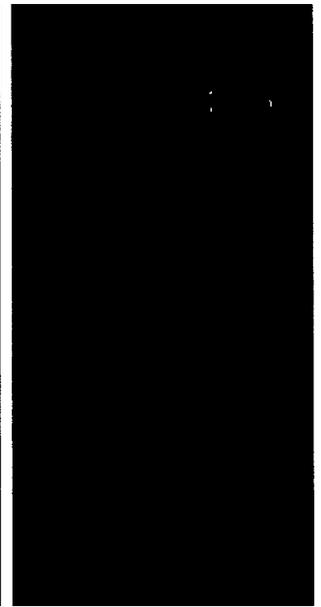
Fig. 115-117



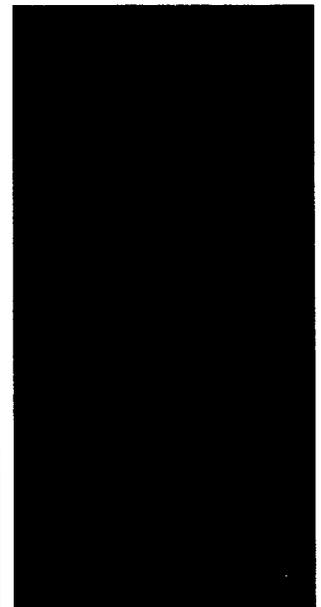
115a



116a



117a



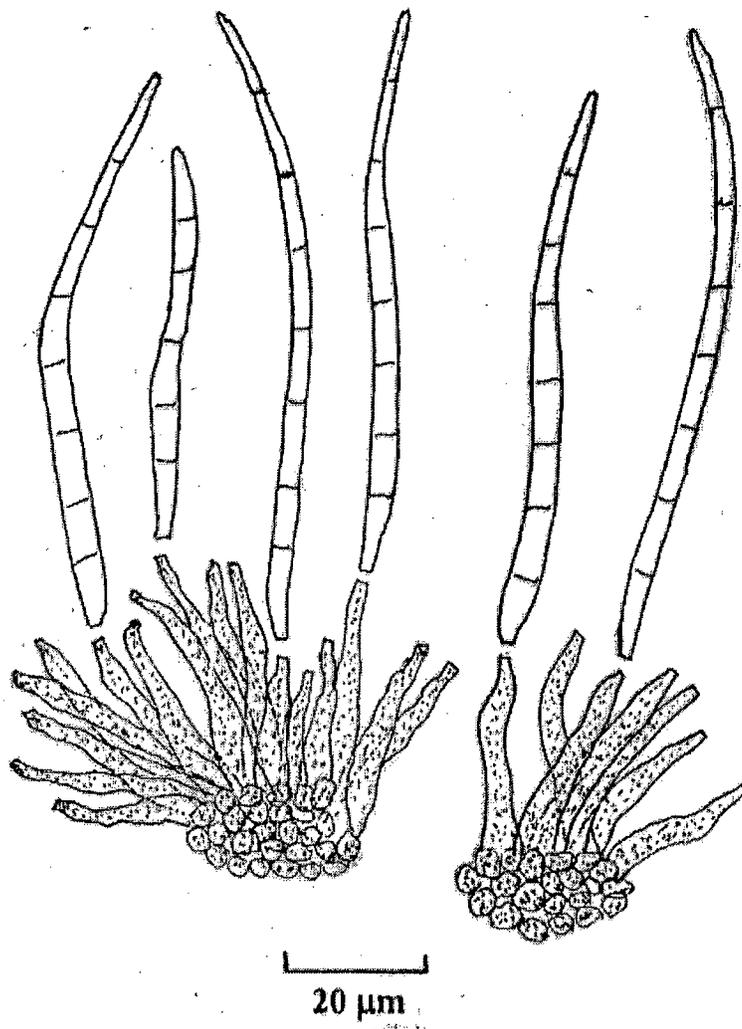


Fig. 116d *Pseudocercospora rhamnaceicola*

So far, five species of *Pseudocercospora*, viz. *P. jujubae* (Chowdhury) Khan & Shamsi, *P. rhamnaceicola*, *P. vitis* (Lev.) Speg., *P. ziziphicola* (Yen) Yen and *P. zizyphi* (Petch) Crous & Braun, are reported on *Ziziphus*. On comparison with these 5 species, our isolate showed similarities with *P. rhamnaceicola* with respect to conidiophores and conidial dimensions.

117. *Pseudocercospora stahlia* (F. Stevens) Deighton, 1976. *Mycol. Pap.* 140: 82

(Fig.117a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, initially light green, later turning to dark green, spreading on entire leaf surface 3-4 mm wide. *Colonies* on leaf spots effuse, dark green, velvety. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, brown, smooth, thick-walled, branched, septate, 100-175 x 3-5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, determinate, integrated, sympodial, denticulate, 25-70 x 3-5 μm ; conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, pale brown, 2-3 septate, smooth, straight to slightly curved, 20-40 x 4-7 μm ; hilum unthickened, not darkened.

Specimen examined: On living leaves of *Passiflora foetida* Linn. (Passifloraceae), Bambolim, Salcete Goa, 10/10/03, Pratibha, J., Herb. No. GUBH P105.

Two species of *Pseudocercospora*, i.e. *P. fuscovirens* (Sacc.) Y.L. Guo & X.J. Liu and *P. stahlia* were so far reported from *Passiflora*.

118. *Pseudocercospora tabernaemontanae* (Syd. & P. Syd.) Deighton, 1976. *Mycol.*

Pap. 140: 154

(Fig.118a-c; 118d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, circular to semi-circular, spots later collapses forming the shot holes, 10-12 mm in diam.

Colonies on leaf spots effuse, brown. *Mycelium* partly immersed. *Stroma* well developed, spherical, pseudoparenchymatous, large, yellow, 45-60 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, light yellow, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, septate, 15-40 x 2.5-5 µm. *Conidiogenous cells* polyblastic, terminal and intercalary, determinate, integrated, sympodial, denticulate; conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, light olivaceous, pluriseptate, scolecosporous, smooth, straight to slightly curved, 40-110 x 3-5.5 µm; hilum unthickened, not darkened.

Specimen examined: On living leaves of *Tabernaemontana hyaneana* Wall. (Apocynaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P96; Culture No. GUFCC No. 4932.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.4 cm in 7 days, irregular, cartilaginous, dark green, margin serrated, reverse black.

This is the second report of *P. tabernaemontanae* on the host genus *Tabernaemontana*.

119. *Pseudocercospora tectonicola* J.M. Yen, A.K. Kar & B.K. Das, 1982. *Mycotaxon* 16(1): 68 (Fig.119a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, irregular patch covering 10-12 mm wide area. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, thick-walled, unbranched, 0-1 septate, light brown, 16-38 x 2-3.5 µm. *Conidiogenous cells* monoblastic, rarely polyblastic, terminal, determinate, integrated, denticulate, smooth. conidial scars unthickened, not darkened. *Conidia* solitary, simple,

acrogenous, sub-hyaline, pluriseptate, scolecosporous, smooth, obovoid, acicular, straight to slightly curved, 37-118 x 2-3 μm . hilum unthickened, not darkened.

Specimen examined: On living leaves of *Tectona grandis* Linn. (Verbenaceae), Mashem, Canacona, Goa, 16/10/04, Pratibha, J., Herb. No. GUBH P178.

Only one species of *Pseudocercospora*, *P. tectoncola*, is so far reported on the host genus *Tectona*.

120. *Pseudocercospora viticigena* M. Yen, A.K. Kar & B.K. Das, 1982. *Mycotaxon* 16(1): 68 **(Fig.120a-c)**

Fungus Hyphomycete. *Leaf spots* amphigenous, brown, circular, sometimes irregular, 2-3 mm in diam. *Colonies* on leaf spots effuse, dark green, hairy. *Mycelium* immersed. *Stroma* brown spherical, 40-50 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to flexuous, unbranched, septate, smooth, greenish brown, 14-25 x 3-4 μm . *Conidiogenous cells* monoblastic, integrated, terminal, determinate, sympodial, denticulate. *Conidia* catenate, dry, simple, acropleurogenous, scolecosporous, filiform, sub-hyaline, smooth, pluriseptate, straight to slightly flexuous, 35-70 x 2.5-3.5 μm .

Specimen examined: On living leaves of *Vitex* sp. (Verbenaceae), Mashem, Canacona Goa, 13/02/04, Pratibha, J., Herb. No. GUBH P224.

Four species of *Pseudocercospora*, viz. *P. agarwalii* (Chupp) Chi, *P. viticigena* Yen, Kar & Das, *P. viticis* Sawada ex Goh & Hsieh and *P. viticis-quinatae* (Yen) Yen, were so far reported on the host genus *Vitex*. Our collection resembled *P. viticigena* with respect to morphology and size of the conidiophores and conidia, with a little variation in length of conidiophores.

Fig. 118a-c: *Pseudocercospora tabernaemontanae*

118a- Leaf spots

118b- Conidiomata

118c- Conidium

Fig. 119a-c: *Pseudocercospora tectoncola*

119a- Leaf spots

119b- Conidiomata

119c- Conidium

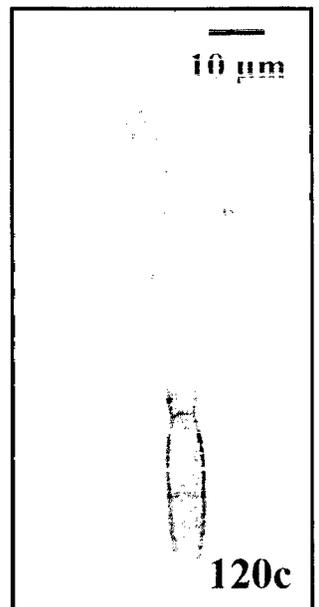
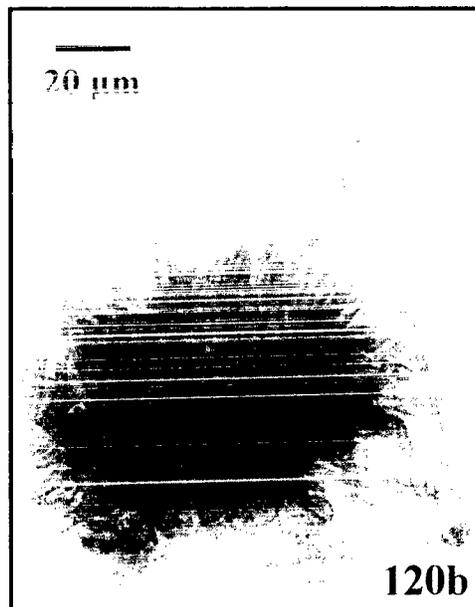
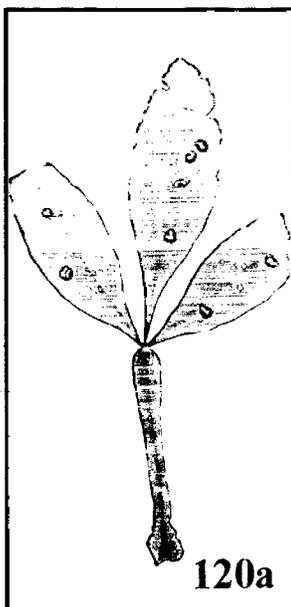
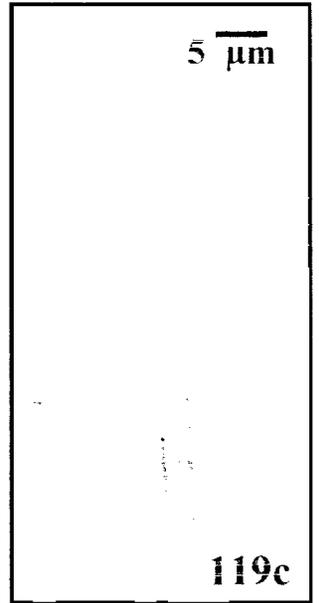
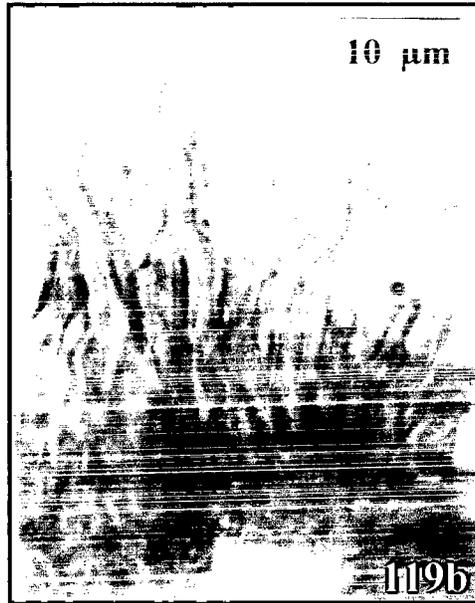
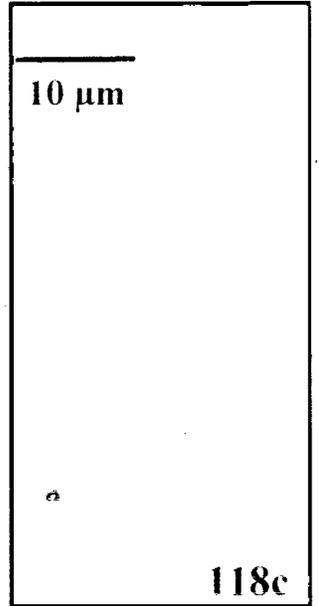
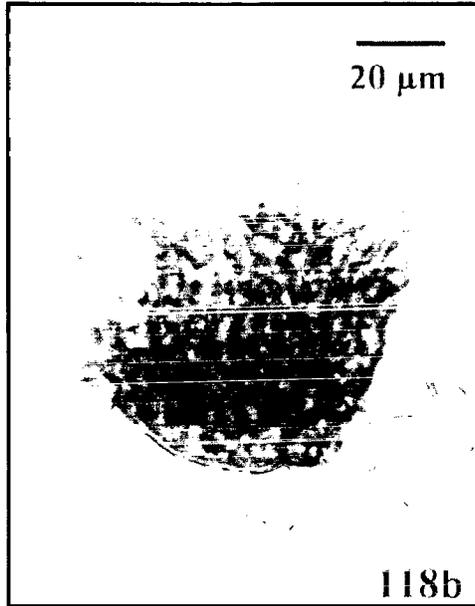
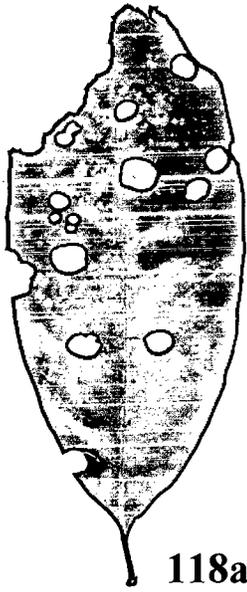
Fig. 120a-c: *Pseudocercospora viticigena*

120a- Leaf spots

120b- Conidiomata

120c- Conidium

Fig. 118-120



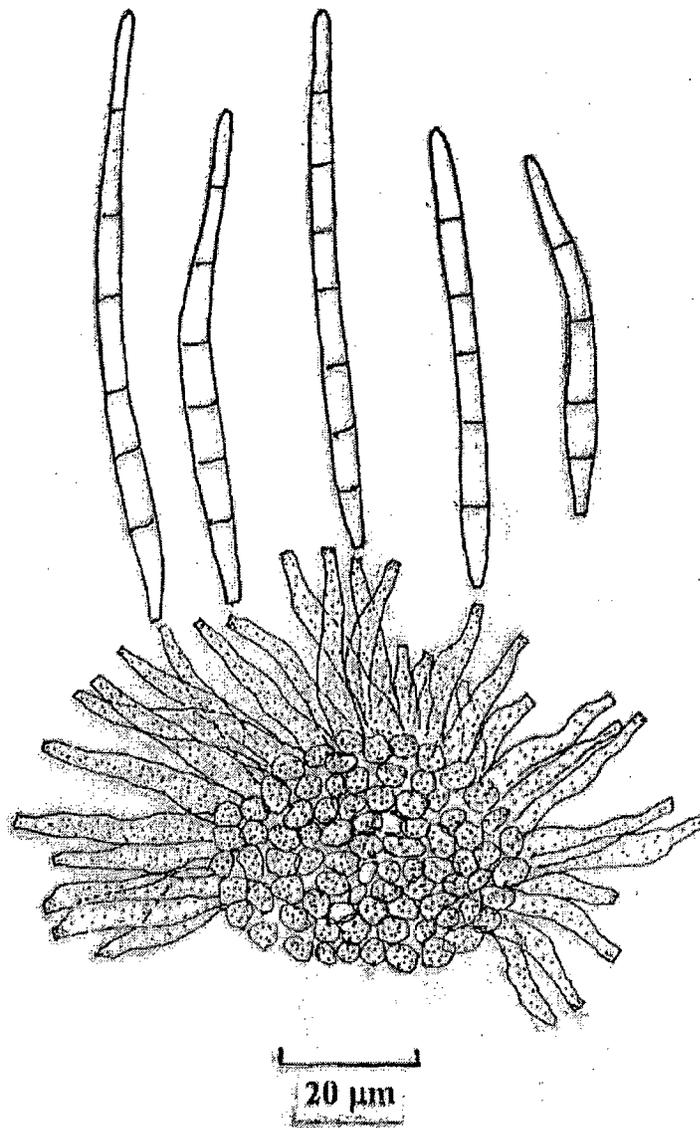


Fig. 118d *Pseudocercospora tabernaemontanae*

121. *Pseudocercospora* sp. 1

(Fig.121a-c; 121d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown, 5-6 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, dark brown, 80-215 x 2-4 μm . *Conidiogenous cells* polyblastic, terminal as well as intercalary, determinate, integrated, sympodial, light brown, smooth, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, pale olivaceous, pluriseptate, scolecosporous, acicular, smooth, straight, 33-98 x 3-4.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Wendlandia thyrsoides* (Roem. & Schult.) Steud. (Rubiaceae), Valpoi, Sattari Goa, 19/02/04, Pratibha, J., Herb. No. GUBH P122.

122. *Pseudocercospora* sp. 2

(Fig.122a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, irregular. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed in the host tissue. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, olivaceous brown, 20-55 x 2-3 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, light olivaceous, smooth, denticulate with unthickened, not darkened conidial scars. *Conidia* solitary, simple, acrogenous, pale olivaceous, pluriseptate, smooth, straight, with unthickened, not darkened hilum, 12-27 x 2-3 μm .

Specimen examined: On living leaves of *Achras sapota* Linn. (Sapotaceae), Calem, Sanguem Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P139.

Fig. 121a-c: *Pseudocercospora* sp.1

121a- Leaf spots

121b- Conidiomata

121c- Conidium

Fig. 122a-c: *Pseudocercospora* sp.2

122a- Leaf spots

122b- Conidiomata

122c- Conidium

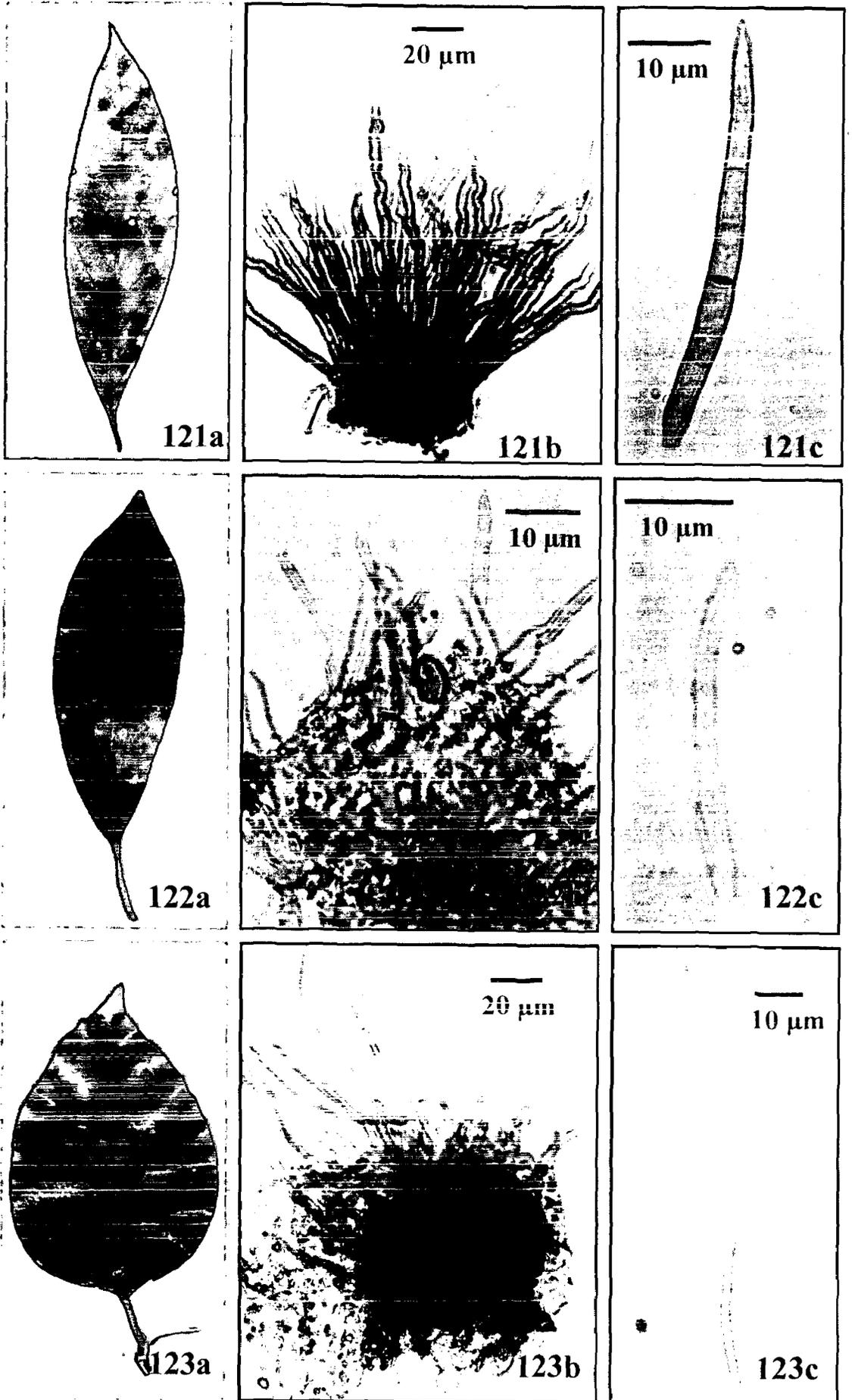
Fig. 123a-c: *Pseudocercospora* sp.3

123a- Leaf spots

123b- Conidiomata

123c- Conidium

Fig. 121-123



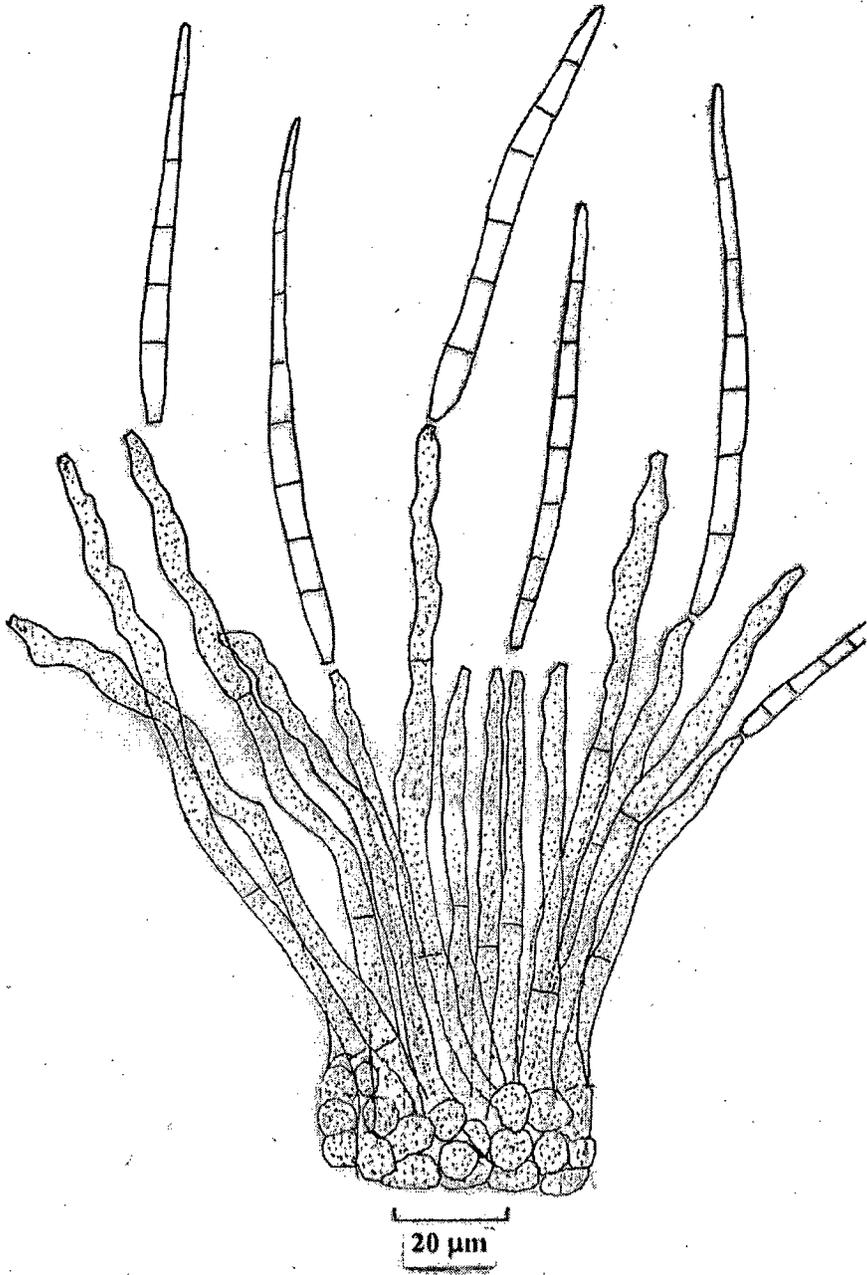


Fig. 121d *Pseudocercospora* sp. 1

123. *Pseudocercospora* sp. 3**(Fig.123a-c)**

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, initially light yellow later becoming brown, 3-5 mm wide. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* dark brown, parenchymatous, 30-40 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, light olivaceous, erect, straight to slightly flexuous, unbranched, septate, smooth, 30-97 x 2-3.5 µm. *Conidiogenous cells* polyblastic, terminal and intercalary, determinate, integrated, sympodial, denticulate, smooth, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, hyaline, pluriseptate, scolecosporous, acicular, smooth, straight, truncate at the base, 50-107 x 2-3.5 µm. hilum unthickened, not darkened.

Specimen examined: On living leaves of *Jasminum malabaricum* Wight (Oleaceae), Chorla, Sattari, Goa, 02/07/04, Pratibha, J., Herb. No. GUBH P146; Culture No. GUFCC No. 4933.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.4 cm in 7 days, circular, fibrous, white, margin serrated, reverse off-white.

124. *Pseudocercospora* sp. 4**(Fig.124a-c)**

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, grayish brown in the centre with dark brown margin surrounded by yellow halo, 2-6 mm in diameter, spreading on entire leaf surface, most of the leaves of the plant showed infection. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* brown, spherical, 40-55.5 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, light brown, erect, straight to slightly flexuous, unbranched, 0-1 septate, smooth, 10-33.5 x 2-3.5 µm. *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, determinate, integrated, sympodial,

denticulate, smooth, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, light olivaceous, pluriseptate, scolecosporous, smooth, straight, truncate at the base, tip sub-acute, 32.5-75.5 x 2.5-4 µm. hilum unthickened, not darkened.

Specimen examined: On living leaves of *Cosmostigma racemosa* (Roxb.) Wight, (Asclepiadaceae), St. Estevem, Tiswadi, Goa, 09/07/04, Pratibha, J., Herb. No. GUBH P150.

125. *Pseudocercospora* sp. 5

(Fig.125a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, dark brown to black, 3-5 mm in diameter, few spots were observed on each leaf. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* spherical, brown, 40-65 µm. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, olivaceous brown, 10-33 x 2-3 µm. *Conidiogenous cells* monoblastic, terminal, determinate, integrated, light brown, smooth, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, pale olivaceous, pluriseptate, scolecosporous, acicular, smooth, straight to slightly curved, 23-75 x 2-3 µm, hilum unthickened, not darkened.

Specimen examined: On living leaves of *Ficus arnottiana* (Miq.) Miq. (Rubiaceae), Sawantwadi, Maharashtra, India. 17/07/04, Pratibha, J., Herb. No. GUBH P157.

126. *Pseudocercospora* sp. 6

(Fig.126a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, brown, 3-5 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* spherical, brown, parenchymatous, 50-60 µm. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled,

Fig. 124a-c: *Pseudocercospora* sp.4

124a- Leaf spots

124b- Conidiomata

124c- Conidium

Fig. 125a-c: *Pseudocercospora* sp.5

125a- Leaf spots

125b- Conidiomata

125c- Conidia

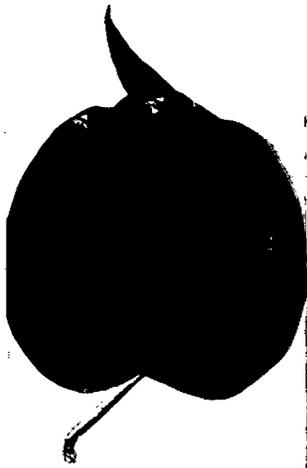
Fig. 126a-c: *Pseudocercospora* sp.6

126a- Leaf spots

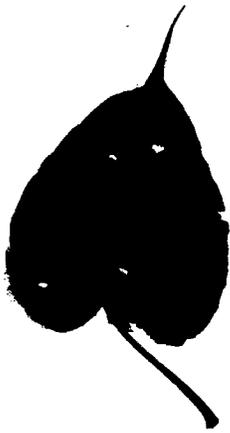
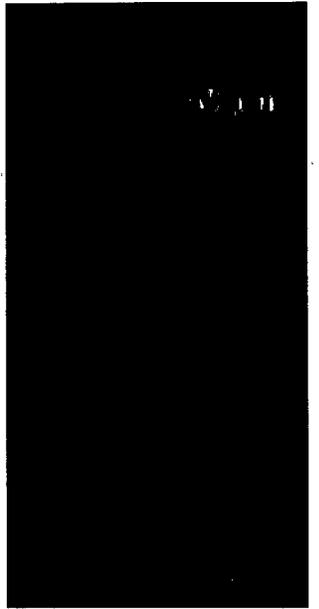
126b- Conidiomata

126c- Conidium

Fig. 124-126



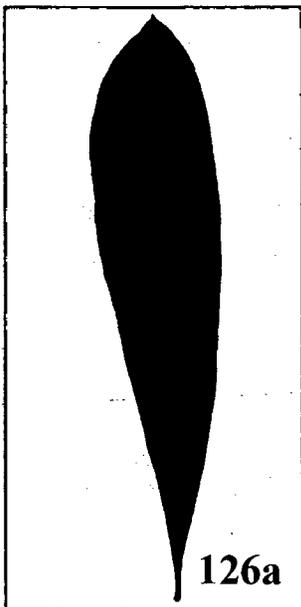
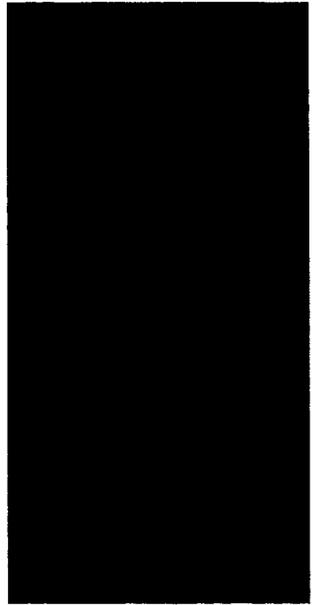
124a



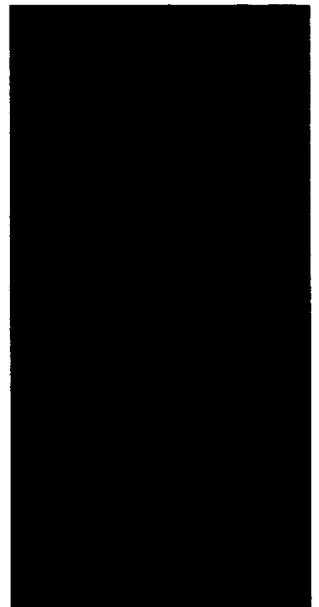
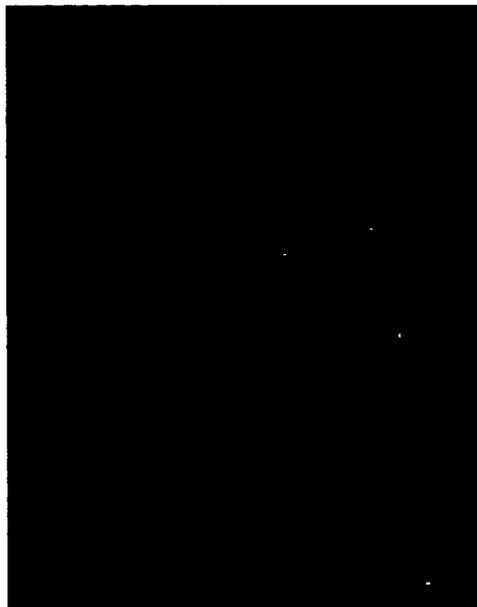
125d



125e



126a



olivaceous brown, 10-35 x 2-3.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, light brown, smooth, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, pale olivaceous, pluriseptate, scolecosporous, smooth, straight, truncate at the base, rounded at the apex, 27-48 x 2-3.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Garcinia indica* Choisy (Clusiaceae), Colem, Sanguem, Goa, 31/07/04, Pratibha, J., Herb. No. GUBH P164.

127. *Pseudocercospora* sp. 7

(Fig.127a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, semi-circular to irregular patches spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* sub-sphaerical, pseudoparenchymatous, dark brown, 30-45 μm . *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, dark brown, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, septate, 20-58 x 3-4 μm . *Conidiogenous cells* polyblastic, terminal and intercalary, determinate, integrated, sympodial, denticulate, smooth. conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, sub-hyaline, 1-4 septate, scolecosporous, smooth, 18-48 x 3-4.5 μm . hilum unthickened, not darkened.

Specimen examined: On living leaves of *Adina cordifolia* Hook. (Rubiaceae), Polem, Canacona, Goa, 26/12/04, Pratibha, J., Herb. No. GUBH P180; Culture No. GUFCC No. 4934.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.1 cm in 7 days, circular, leathery, dark brown, margin serrated, reverse light brown.

128. *Pseudocercospora* sp. 8

(Fig.128a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white, circular, 4-8 mm in

diam., spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown. *Mycelium* partly immersed, partly superficial, composed of thin, slender, branched, septate, hyaline, smooth, 2-3 μm wide hyphae; *Stroma* well-developed, spherical, pseudoparenchymatous, dark brown, 35-45 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, light brown, erect, straight to slightly flexuous, smooth, thick-walled, sometimes branched, septate, 30-80 x 4-5 μm . *Conidiogenous cells* polyblastic, terminal and intercalary, determinate, integrated, denticulate. conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, light olivaceous, pluriseptate, scolecosporous, smooth, 30-87 x 2-5 μm . hilum unthickened, not darkened.

Specimen examined: On living leaves of *Adina cordifolia* Hook. (Rubiaceae), Hankani, Uttara Kanada, Karnataka, India. 26/12/04, Pratibha, J., Herb. No. GUBH P183; Culture No. GUFCC No. 4935.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.7 cm in 7 days, irregular, leathery, dark brown, margin serrated, reverse black.

129. *Pseudocercospora* sp. 9

(Fig.129a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, irregular, 2-6 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* sub-sphaerical, pseudoparenchymatous, dark brown, 40-55 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, dark brown, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, septate, 20-85 x 3-4.5 μm . *Conidiogenous cells* polyblastic, terminal and intercalary, determinate, integrated, denticulate, smooth; conidial scars unthickened, not darkened. *Conidia* solitary,

Fig. 127a-c: *Pseudocercospora* sp.7

127a- Leaf spots

127b- Conidiomata

127c- Conidium

Fig. 128a-c: *Pseudocercospora* sp.8

128a- Leaf spots

128b- Conidiomata

128c- Conidia

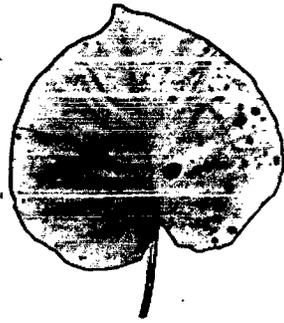
Fig. 129a-c: *Pseudocercospora* sp.9

129a- Leaf spots

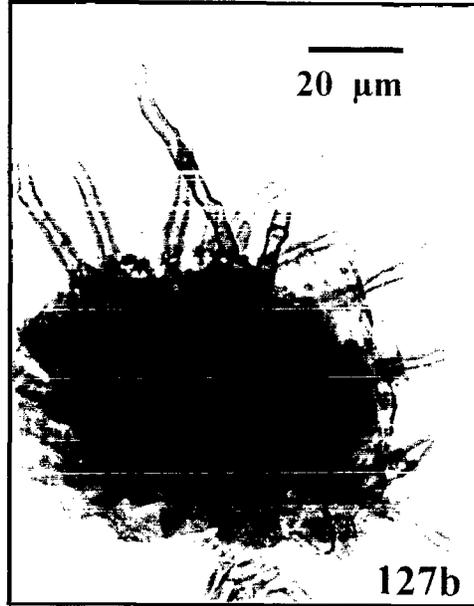
129b- Conidiomata

129c- Conidium

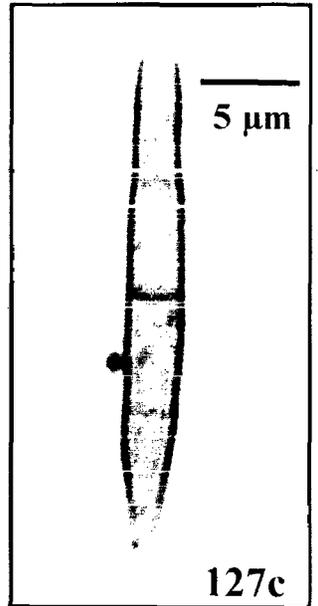
Fig. 127-129



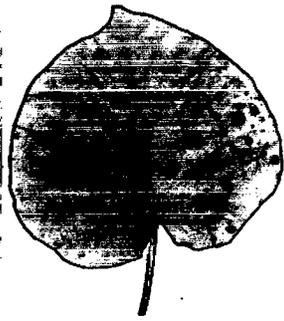
127a



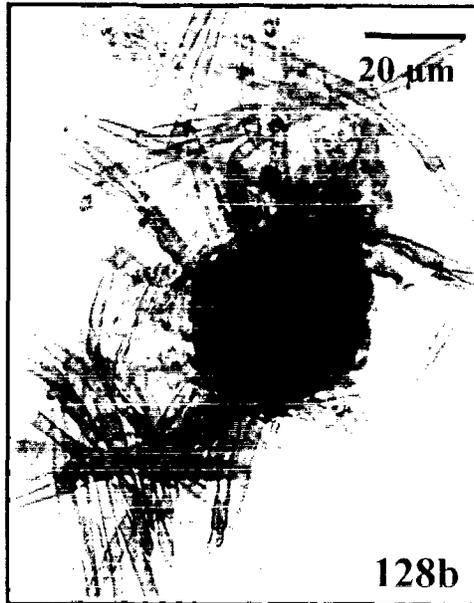
127b



127c



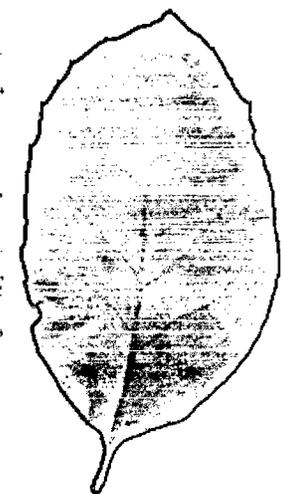
128a



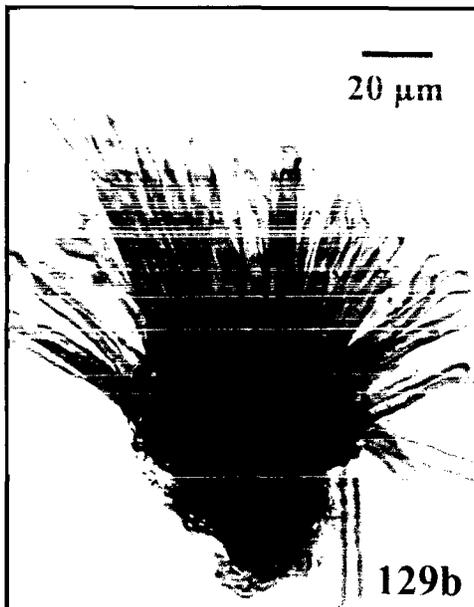
128b



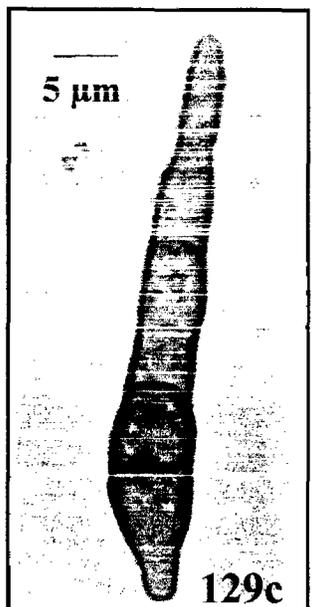
128c



129a



129b



129c

simple, acropleurogenous, light olivaceous, pluriseptate, scolecosporous, smooth, 18-48 x 3-4.5 μm . hilum unthickened, not darkened.

Specimen examined: On living leaves of Undetermined taxon, Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P190; Culture No. GUFCC No. 4936.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.7 cm in 7 days, irregular, cartilagenous, dark brown, margin serrated, reverse brown.

130. *Pseudocercospora* sp. 10

(Fig.130a-c; 130d)

Fungus Hyphomycete. *Leaf spots* amphigenous, mostly circular, sometimes irregular, brown with dark brown or black margin, 2-5 mm in diameter, spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Stroma* spherical, parenchymatous, brown, 40-60 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, light brown, unbranched, 0-1 septate, 20-45 x 3-5 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, determinate, integrated, sympodial, denticulate, scars unthickened, not darkened. *Conidia* solitary, simple, straight, pluriseptate, smooth, light olivaceous, scolecosporous, 32-75 x 3-5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Azadirachta indica* Juss. (Meliaceae), Banastari, Ponda Goa, 19/11/03, Pratibha, J., Herb. No. GUBH P115.

131. *Pseudocercospora* sp.

(Fig.131a-c; 131d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, semicircular, 4-6 mm in diam., later spreading on entire leaf surface, most of the leaves of the each plant showed infection. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed in the host tissue. *Stroma large*, dark yellow, spherical, 35-45 μm in diam. *Setae* and

hyphopodia absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, light yellow 12-35 x 2-4 μm . *Conidiogenous cells* polyblastic, terminal, determinate, integrated, smooth, denticulate; conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, hyaline, pluriseptate, scolecosporous, acicular, smooth, straight, 37-105 x 3-5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Elephantopus scaber* Linn. (Asteraceae), Sawantwadi, Maharashtra, India, 29/11/03, Herb. No. GUBH P119; Paryem, Sattari Goa, 02/07/04, Herb. No. GUBH P119; Colem, Sanguem Goa, 03/07/04, Herb. No. GUBH P119; Bondla, Ponda Goa, 09/07/04, Herb. No. GUBH P119; Culture No. GUFCC No. 4937.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.2 cm in 7 days, circular, cartilaginous, light green, margin smooth, reverse dark green.

132. *Pseudocercospora* sp. 12

(Fig.132a-c; 132d)

Fungus Hyphomycete. *Leaf spots* amphigenous, initially light brown, later turning dark brown to black, circular, 2-6 mm in diam., spreading on entire leaf surface, almost all leaves of the plant showed infection. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed in the host tissue. *Stroma* dark yellow, spherical, 40-50 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, arising from stomata, in dense fascicles, erect, straight to slightly flexuous, unbranched, septate, smooth, olivaceous to light yellow 17-40 x 3-5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, light olivaceous, smooth, denticulate, conidial scars unthickened, not darkened. *Conidia* solitary, simple, acrogenous, pale olivaceous, pluriseptate, scolecosporous, acicular, smooth, straight, 20-87 x 2.5-4.5 μm hilum unthickened, not darkened.

Fig. 130a-c: *Pseudocercospora* sp.10

130a- Leaf spots

130b- Conidiomata

130c- Conidium

Fig. 131a-c: *Pseudocercospora* sp.11

131a- Leaf spots

131b- Conidiomata

131c- Conidium

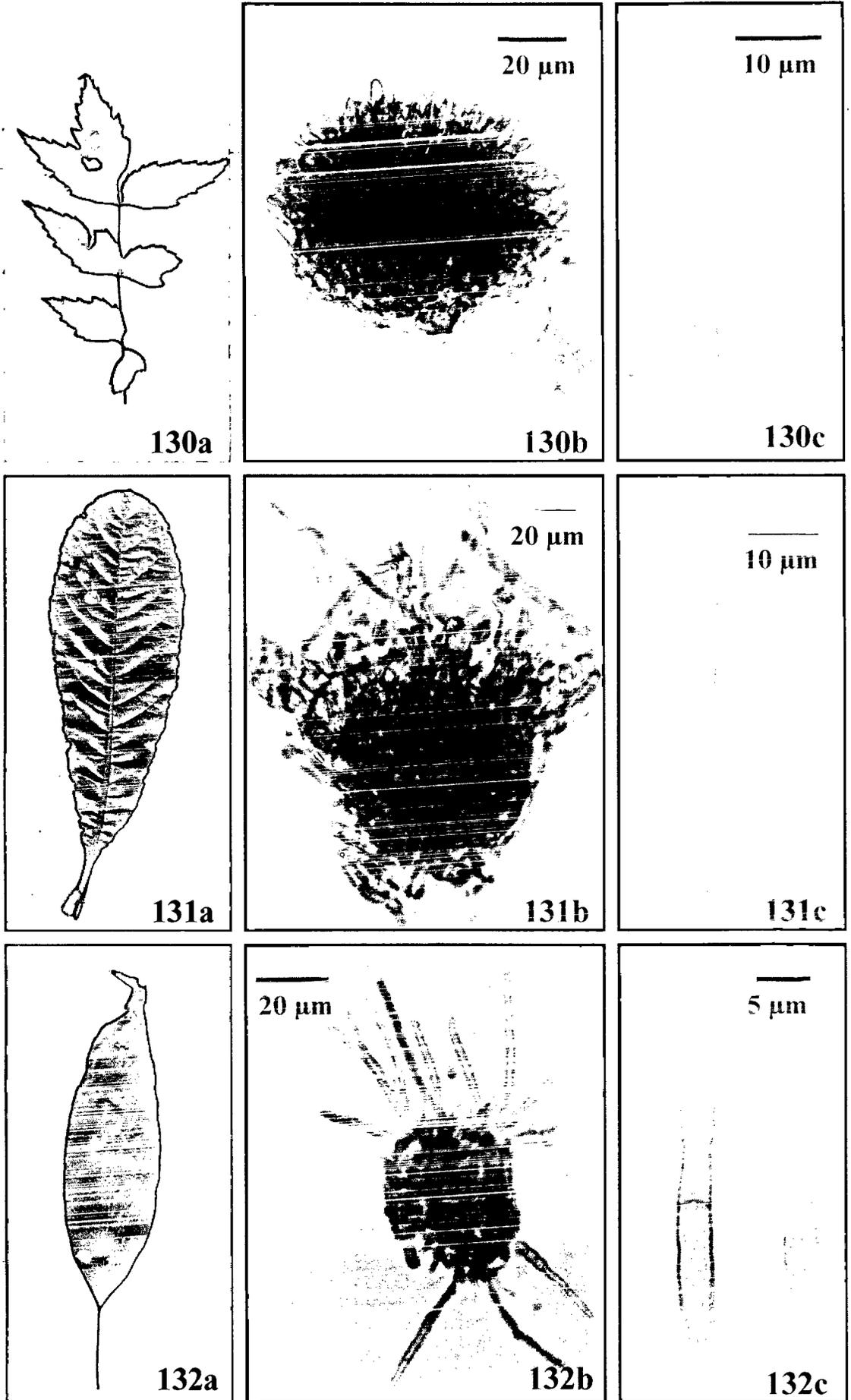
Fig. 132a-c: *Pseudocercospora* sp.12

132a- Leaf spots

132b- Conidiomata

132c- Conidia

Fig. 130-132



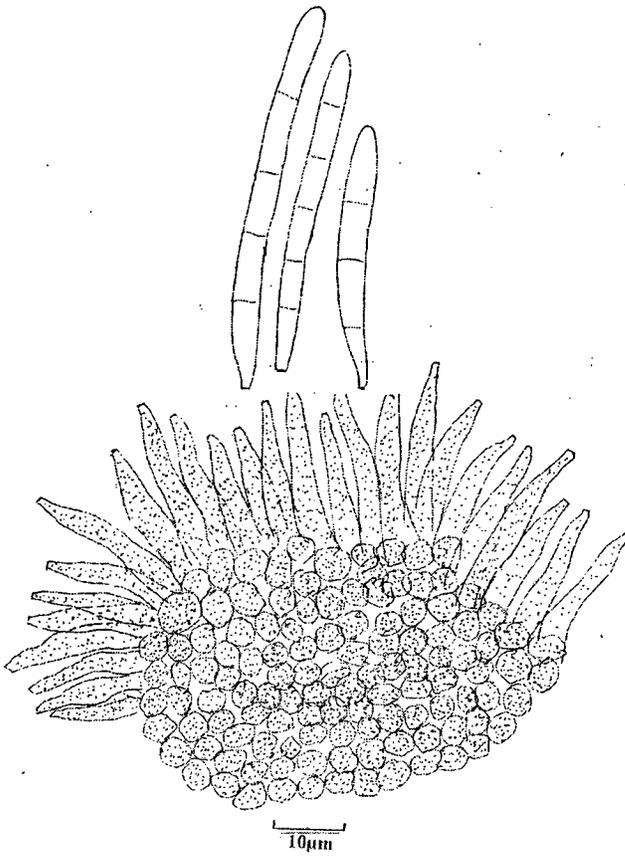


Fig. 130d *Pseudocercospora* sp. 10

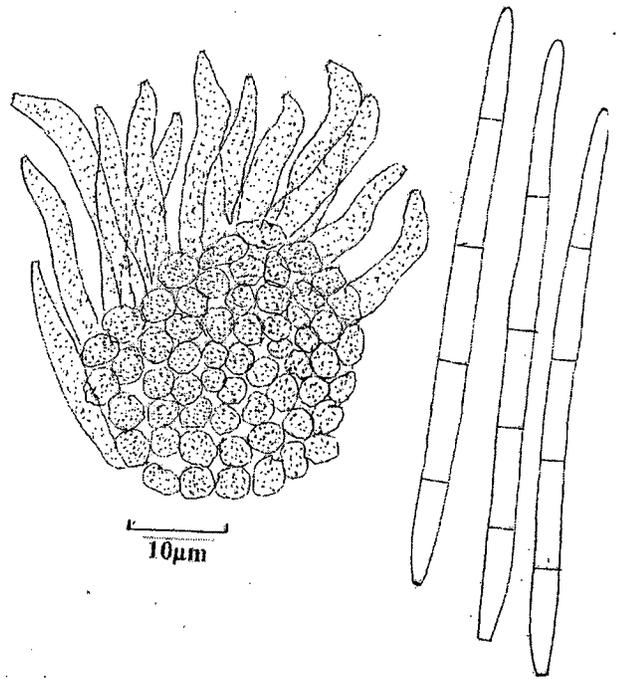


Fig. 131d *Pseudocercospora* sp. 11

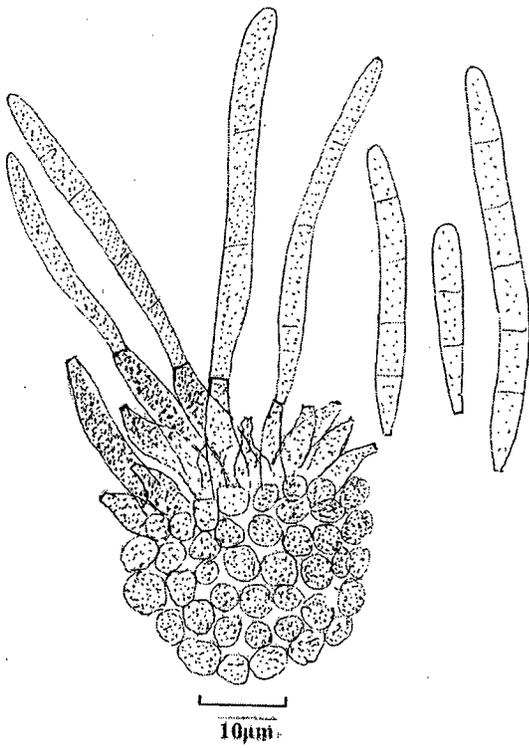


Fig. 132d *Pseudocercospora* sp. 12

Specimen examined: On living leaves of *Vitex negundo* Linn. (Verbenaceae), Amboli, Maharashtra, India, 29/11/03, Herb. No. GUBH P120; Asagao Bardez Goa, 16/06/04, Herb. No. GUBH P120; Paryem, Sattari Goa, 02/07/04, Herb. No. GUBH P120; Valpoi, Sattari Goa, 25/07/04, Pratibha, J., Herb. No. GUBH P120.

133. *Pseudocercospora* sp. 13

(Fig.133a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown, 2-3 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Stroma* spherical, parenchymatous, dark brown, 40-60 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, light brown, unbranched, 0-1 septate, 20-505 x 3-4.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, denticulate, scars unthickened, not darkened. *Conidia* solitary, simple, straight, pluriseptate, acicular, acrogenous, smooth, light olivaceous, scolecosporous, 45-100 x 2-4.5 μm , hilum unthickened, not darkened.

Specimen examined: On living leaves of *Anacardium occidentale* Linn. (Anacardiaceae), Calem, Sanguem, Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P134.

The above 13 taxa of *Pseudocercospora* remained unidentified due to want of literature.

134. *Pseudocercosporella* sp. 1

(Fig.134a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, semicircular to irregular, reddish brown 1.5-9 mm in diam. sometimes covering half the surface of leaflet, almost whole plant showed infection. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* light yellow, pseudoparenchymatous, 20-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, hyaline to faintly brown, unbranched, 0-1 septate, 20-45 x 3-4 μm . *Conidiogenous cells* monoblastic, integrated, terminal, determinate,

Fig. 133a-c: *Pseudocercospora* sp.13

133a- Leaf spots

133b- Conidiomata

133c- Conidium

Fig. 134a-c: *Pseudocercosporella* sp. 1

134a- Leaf spots

134b- Conidiomata

134c- Conidium

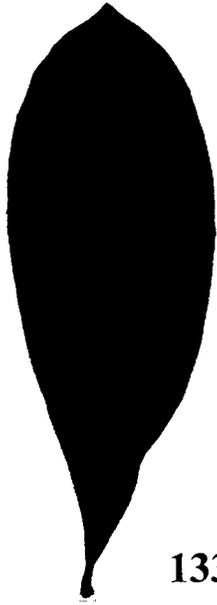
Fig. 135a-c: *Pseudocercosporella* sp. 2

135a- Leaf spots

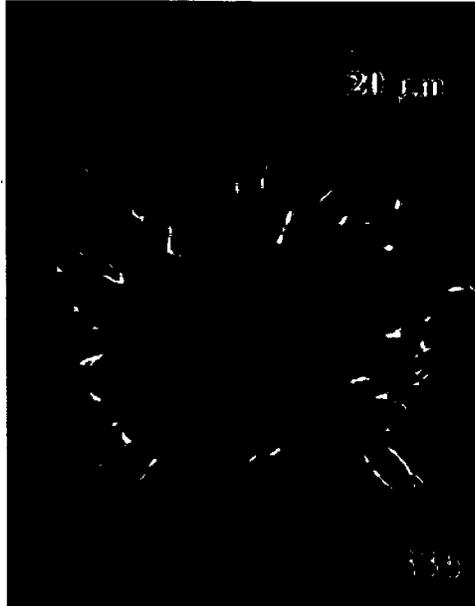
135b- Conidiomata

135c- Conidium

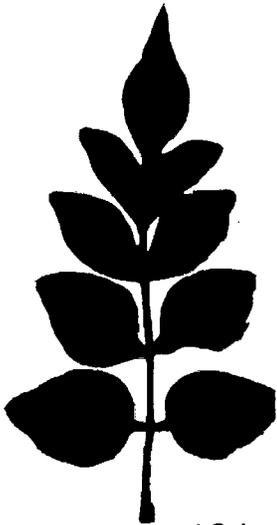
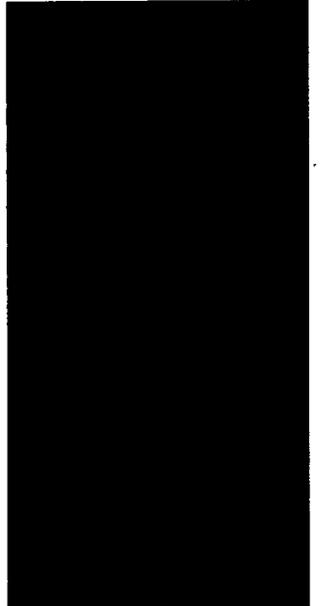
Fig. 133 -135



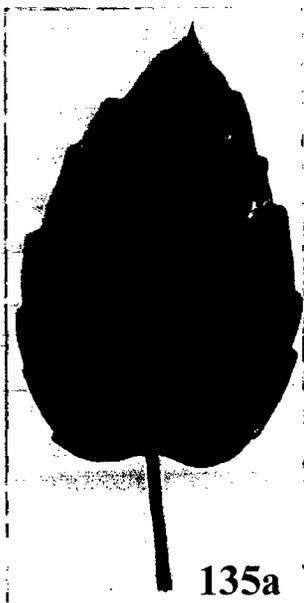
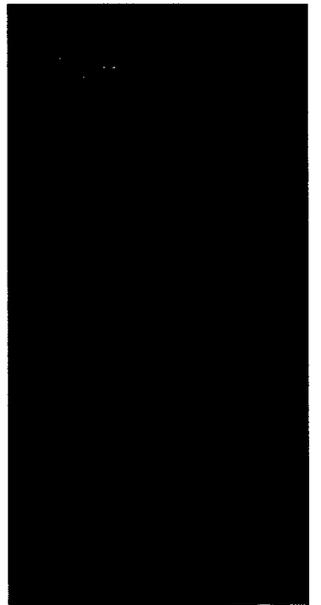
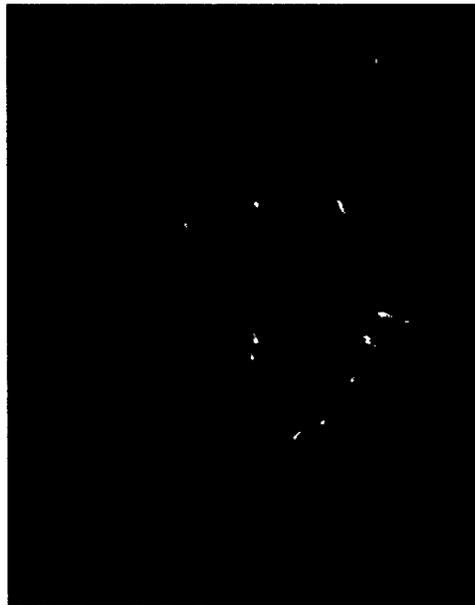
133a



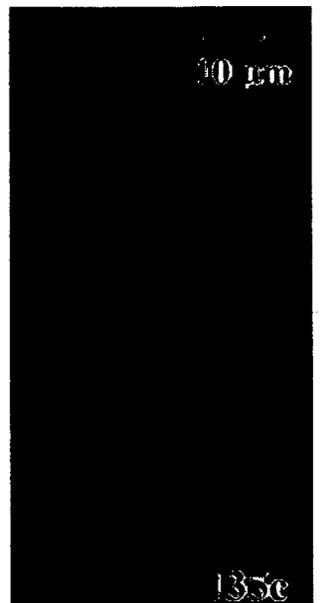
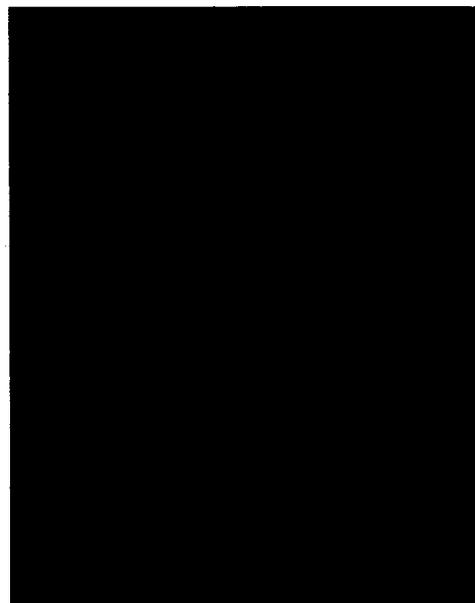
133b



134a



135a



20 μm

135c

denticulate, hyaline, with unthickened, not darkened conidial scars. *Conidia* solitary, dry, simple, acrogenous, straight to slightly curved, pluriseptate, smooth, hyaline, scolecosporous, sub-acute at the tip, truncate the base, hilum unthickened, brown, 40-70 x 2-3.5 μm .

Specimen examined: On living leaves of *Jasminum auriculatum* Vahl. (Oleaceae), Banastari, Ponda Goa, 07/01/03, Herb. No. GUBH P8; University campus, Taleigao Goa, 04/07/04, Herb. No. GUBH P8; Margao, Salcette Goa, 12/08/04, Pratibha, J., Herb. No. GUBH P8.

135. *Pseudocercosporella* sp. 2

(Fig.135a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, semicircular to irregular, reddish brown 1.5-9 mm in diam. sometimes covering half the surface of leaflet, almost whole plant showed infection. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* light yellow, pseudoparenchymatous, 20-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, smooth, hyaline to faintly brown, unbranched, 0-1 septate, 15-55 x 3-4 μm . *Conidiogenous cells* monoblastic, integrated, terminal, determinate, denticulate, hyaline, with unthickened, not darkened conidial scars. *Conidia* solitary, dry, simple, acrogenous, straight to slightly curved, pluriseptate, smooth, hyaline, scolecosporous, sub-acute at the tip, truncate the base, hilum unthickened, not darkened, 35-60 x 2-3.5 μm .

Specimen examined: On living leaves of *Sesamum mulayanum*, University campus, Taleigao Goa, 07/07/04, Pratibha, J. Herb. No. GUBH P148.

The above two taxa of *Pseudocercosporella* remained unidentified due to lack of literature.

136. *Pseudophaeoramularia* sp.

(Fig.136a-c; 136d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grayish brown, circular, 3-5

mm in diam. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* dark brown, spherical, large, 60-100 µm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in small to moderately large dense fascicles, erect, straight to flexuous, unbranched, septate, smooth, dark brown, 20-60 x 3-5 µm. *Conidiogenous cells* polyblastic, integrated, terminal, determinate, sympodial, cicatrized, 16-25 x 6-8 µm with unthickened and not darkened conidial scars. *Conidia* dimorphic, primary conidia obclavate, sub-hyaline, aseptate, truncate at the base, rounded at the apex, 10-17 x 3-5 µm; secondary conidia simple, acropleurogenous, scolecosporous, light brown, smooth, pluriseptate, 20-75 x 3-4.5 µm.

Specimen examined: On living leaves of *Dendrophthoe* sp. (Loranthaceae), Cotigao, Cancona Goa, 13/02/04, Pratibha, J., Herb. No. GUBH P221.

Species of *Pseudophaeoramularia* has earlier been recorded as foliicolous.

137. *Pseudospiropes* sp.

(Fig.137a-c; 137d)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, irregular. *Colonies* on leaf spots effuse, dark brown, velvety. *Mycelium* partly immersed, partly superficial, composed of pale olivaceous, smooth, branched, septate, 2-3.5 µm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, unbranched, septate, smooth, thick walled, dark brown at the base, paler towards the apex, 200-360 x 4-7 µm. *Conidiogenous cells* polyblastic, integrated terminal, sympodial, smooth. *Conidia* solitary, simple, dry, acropleurogenous, brown, smooth, thick-walled, 2-4-septate, 23-32 x 6-9 µm.

Specimen examined: On living leaves of *Dendrocalamus* sp. (Poaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P211.

Fig. 136a-c: *Pseudophaeoramularia* sp.

136a- Leaf spots

136b- Conidiomata

136c- Conidium

Fig. 137a-c: *Pseudospiropes* sp.

137a- Leaf spots

137b- Conidiomata

137c- Conidia

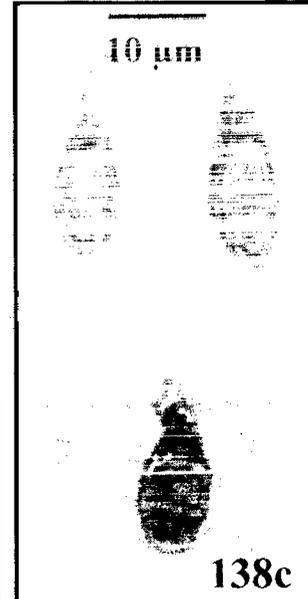
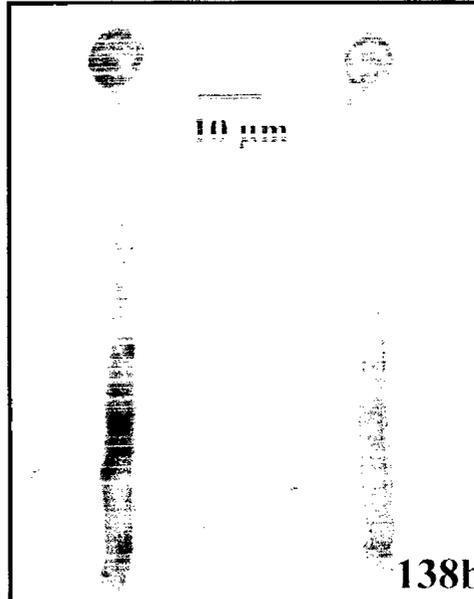
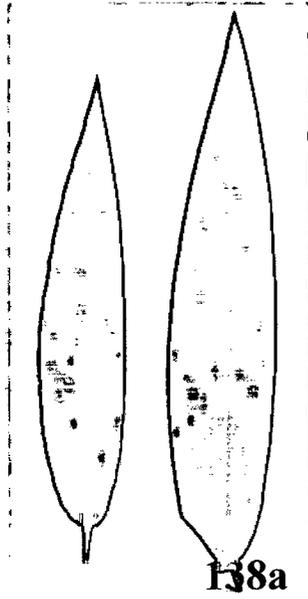
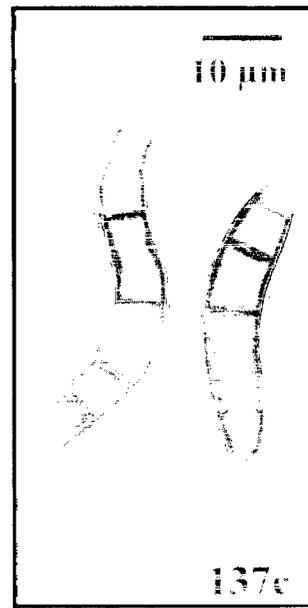
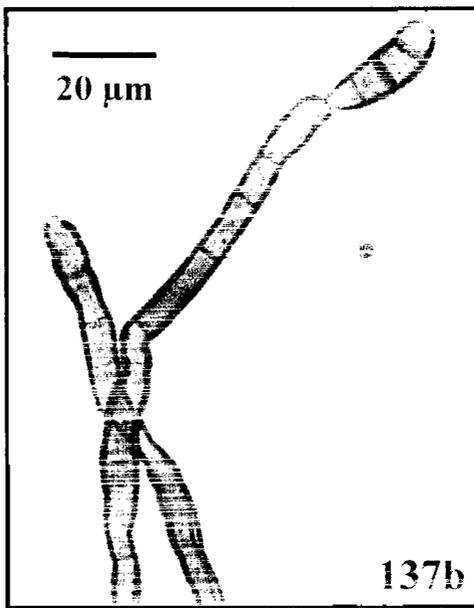
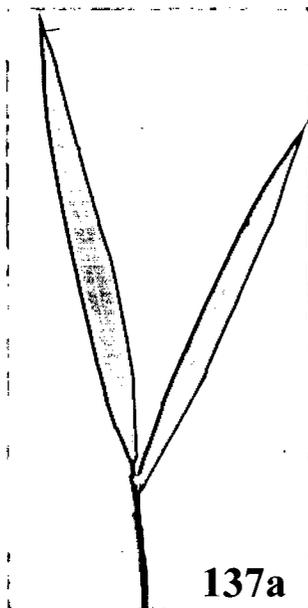
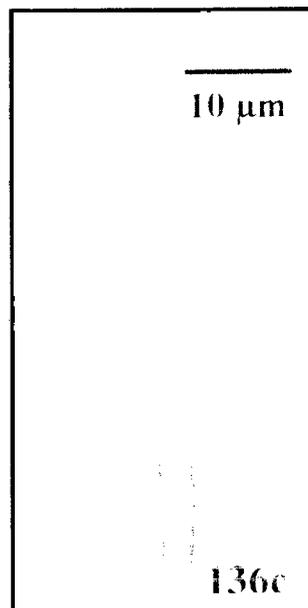
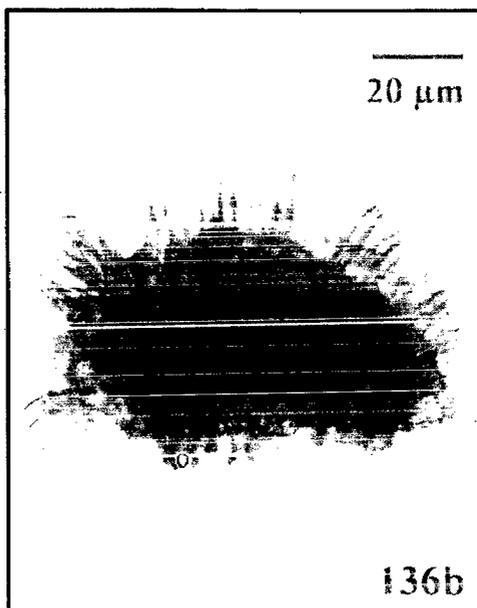
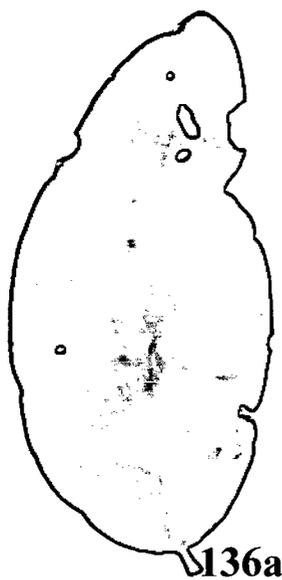
Fig. 138a-c: *Pyricularia oryzae*

138a- Leaf spots

138b- Conidiomata

138c- Conidia

Fig. 136 -138



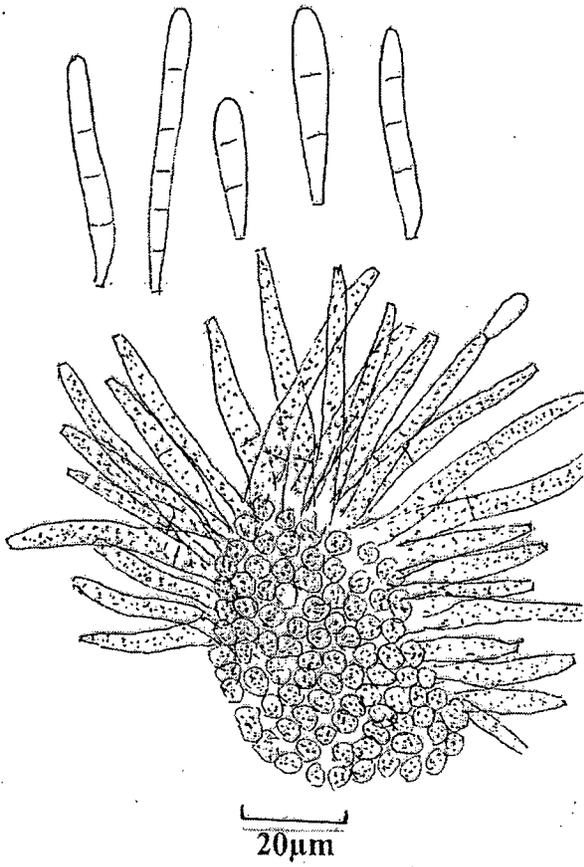


Fig. 136d *Pseudophaeoramularia* sp.

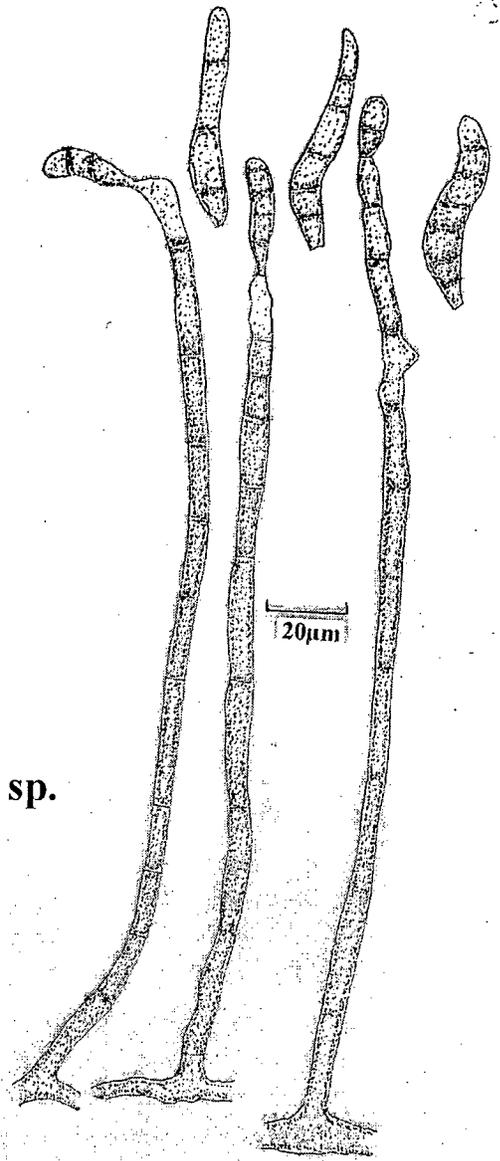


Fig. 137d *Pseudospiropes* sp.

Species of *Pseudospiropes* have so far been known as wood inhabiting fungi.

This is the first record of a species in the genus as foliicolous.

138. *Pyricularia oryzae* Cavara, 1891. *Fung. Long. Exsicc.*, 49 (Fig.138a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, numerous, white in the center with dark brown margin, semi-circular, 1-2 mm in diam., observed on entire leaf surface.

Colonies on leaf spots effuse, light olivaceous, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thin walled, geniculate towards the apex, hyaline to pale olivaceous, 80-115 x 2-4.5 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, geniculate, denticulate, conidial scars unthickened, not darkened, 18-45 x 2-3.5 μm . *Conidia* solitary, simple, dry, acropleurogenous, hyaline, 1-2 septate, obturbinate, 15.5-22.5 x 5-7 μm .

Specimen examined: On living leaves of *Ischaemum* sp. (Poaceae), St. Estevam, Tiswadi, Goa, 19/07/03, Herb. No. GUBH P56; University campus, Taleigao Goa, 12/08/03, Herb. No. GUBH P56; Banastari, Ponda Goa, 14/08/04. Pratibha, J., Herb. No. GUBH P56.

Thirteen species of *Pyricularia* Sacc., were recorded from the grasses. Of these, *P. oryzae* is known to cause the leaf spots of grasses, including rice (Eliis, 1971).

139. *Pyriculariopsis* sp. (Fig.139a-c; 139d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown, 5-6 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse, light brown. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in group of 5-6, erect, straight to slightly flexuous,

unbranched, rarely branched, septate, smooth, thick walled, dark brown at the base, paler at the apex, 165-235 x 5-7 μm . *Conidiogenous cells* polyblastic, terminal and intercalary, integrated, light brown, sympodial, cicatrized, 50-75 x 5-7 μm . *Conidia* solitary, simple, acropleurogenous, straight to slightly curved, smooth, sub-hyaline, scolecosporous, obclavate, 1-4 septate, 40-87 μm long, 6-9 μm wide at the broadest part, 1.5-2.5 μm at the pointed tip.

Specimen examined: On living leaves of *Leea* sp. (Leeaceae), Colem, Sanguem, Goa, 26/08/04, Pratibha, J., Herb. No. GUBH P169; Culture No. GUFCC No. 4938.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.7 cm in 7 days, circular, flat, off-white, margin smooth, reverse colourless.

There are earlier records of *Pyriculariopsis* Ellis, as foliicolous fungus (Eliis, 1976).

140. *Sarcinella* sp.

(Fig.140a-c; 140d)

Fungus Hyphomycete. *Leaf spots* amphigenous dark brown, later turning to black, irregular, 5-7 mm wide. *Colonies* on leaf spots effuse, black brown to black, mycelium superficial, sub-hyaline, smooth, septate, thick -walled, 3-5 μm broad hyphae; *Conidiophores* micronematous, mononematous, smooth, thick- walled, septate, unbranched, light brown. *Hyphopodia* globose, with short stalk. *conidiogenous cells* monoblastic, terminal, integrated. brown *Conidia* solitary, dark brown, sub-spherical, 30-45 μm in diameter, smooth.

Specimen examined: On living leaves of *Bauhinia* sp. (Papilionaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P71.

This is the first record of *Sarcinella* on *Bauhinia* sp. as a foliicolous fungus (Eliis, 1976).

Fig. 139a-c: *Pyriculariopsis* sp.

139a- Leaf spots

139b- Conidiomata

139c- Conidiophores with conidia

Fig. 140a-c: *Sarcinella* sp.

140a- Leaf spots

140b- Conidiomata

140c- Conidium

Fig. 141a-c: *Scolecobasidium constrictum*

141a- Leaf spots

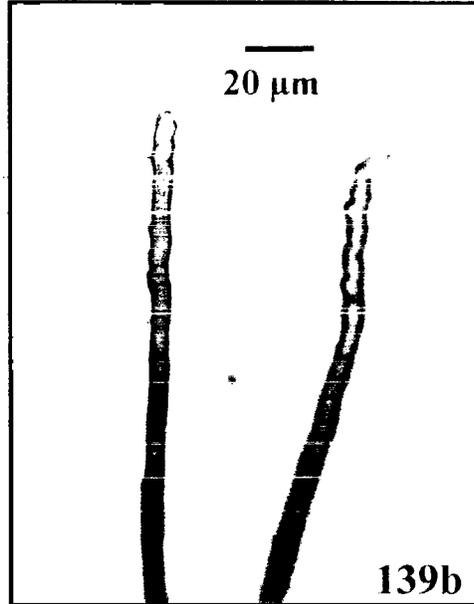
141b- Conidiomata

141c- Conidia

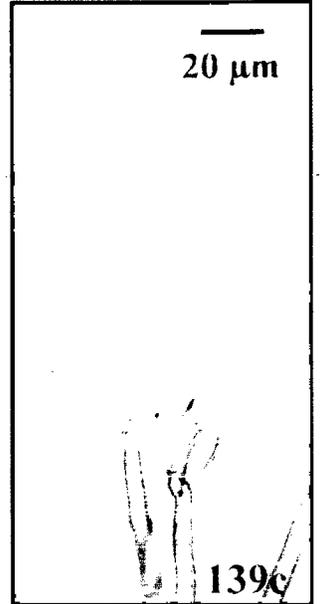
Fig. 139-141



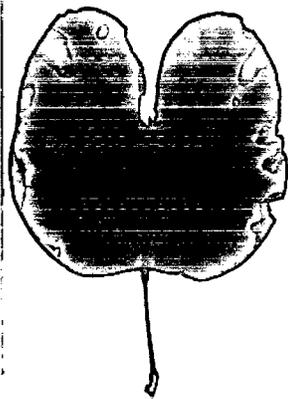
139a



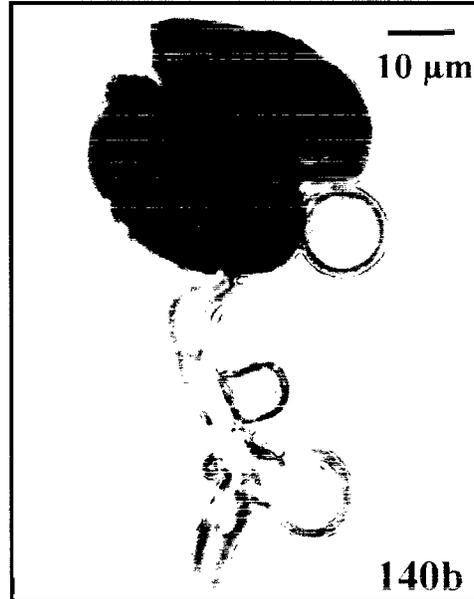
139b



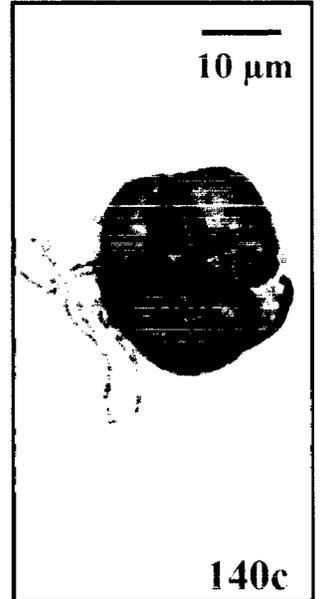
139c



140a



140b



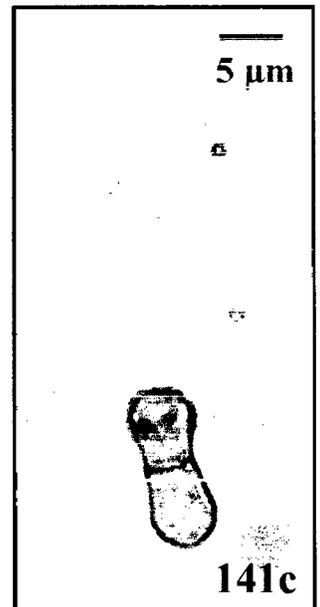
140c



141a



141b



141c

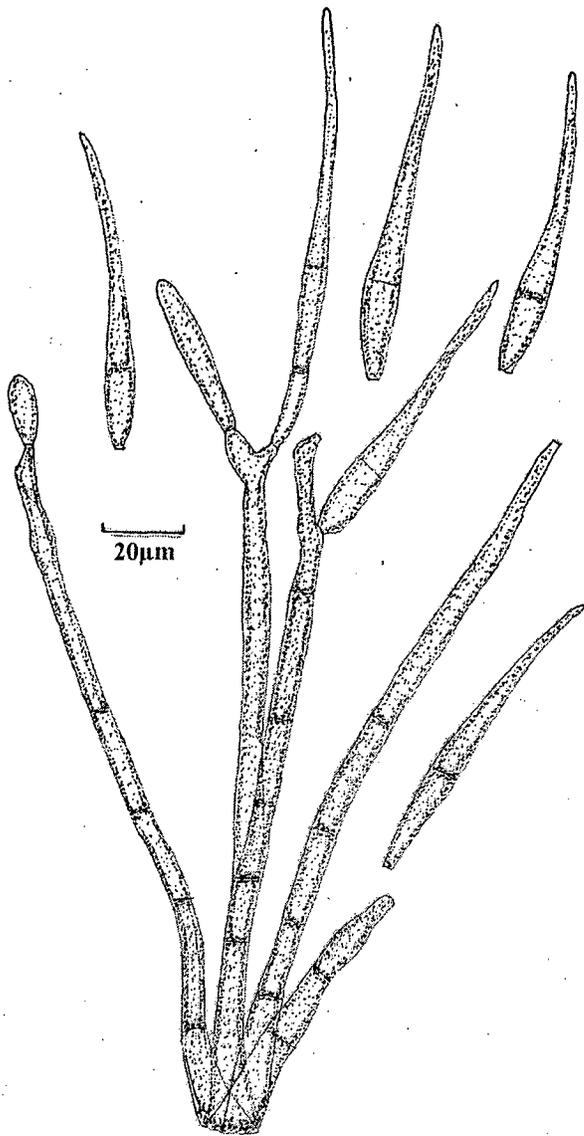


Fig. 139d *Pyriculariopsis* sp.

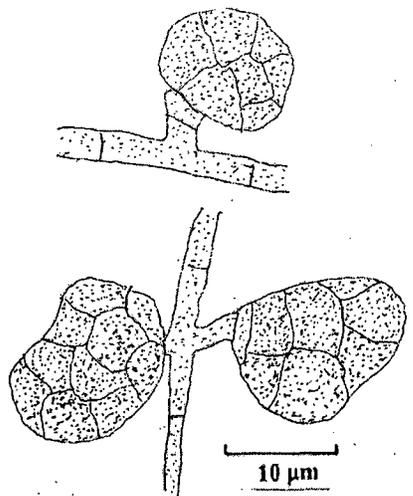


Fig. 140d *Sarcinella* sp.

141. *Scolecobasidium constrictum* E.V. Abbott, 1927. *Mycologia* 19: 30(Fig.141a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, initially yellow later turning to brown, 3-7 mm in diameter, spreading on entire leaf surface. *Colonies* on leaf spots effuse, brown, velvety. *Mycelium* partly immersed, partly superficial, composed of smooth, sub-hyaline, septate, branched, 2-2.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, olivaceous brown, 4-10 x 2.5-4 μm . *Conidiogenous cells* polyblastic, terminal, determinate, integrated, denticulate, sympodial. *Conidia* solitary, dry, simple, acropleurogenous, sub-hyaline, 1-septate, constricted at the septum, smooth, pointed at the base, rounded at the apex, 8-11 x 2.5-4 μm .

Specimen examined: On living leaves of *Ariopsis peltata* Nimmo. (Araceae), Amboli, Sawantwadi, Maharashtra, India. 17/07/04, Herb. No. GUBH P157; St. Estivum Tiswadi Goa, 18/08/04, Herb. No. GUBH P157; Banastari Ponda Goa, 20/08/04, Pratibha, J., Herb. No. GUBH P157.

Till date, about 40 species of *Scolecobasidium* Abbot are reported. Most of them are associated with plant litter and soil. Some were also reported from the green leaves (Ellis, 1971, 1976).

142. *Sirosporium carissae* J.N. Kapoor, 1968. *Trans. Br. mycol. Soc.* 51(2): 330

(Fig.142a-c; 142d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, circular, sometimes irregular, 2-4 mm in diam, in the form of concentric rings. *Colonies* on leaf spots effuse, reddish brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, slender, smooth, hyaline, branched, 2-3.5 μm wide hyphae; *Stroma* dark brown, parenchymatous, spherical, 20-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to

flexuous, unbranched, septate, smooth, dark brown, thick walled 17.5-35.5 x 3.5-7 µm. *Conidiogenous cells* monoblastic, terminal, integrated, determinate, cicatrized, 9.5-22.5 x 3.5-6.5 µm. *Conidia* solitary, dry, simple, olivaceous brown, paler towards the apex, pluriseptate, thick walled, straight to slightly curved, cylindrical with rounded at tip, truncate at the base, verrucose, 35-155 x 3.5-6.5 µm.

Specimen examined: On living leaves of *Carissa carandas* Linn. (Apocynaceae), Banastari, Ponda Goa, 06/04/03, Pratibha, J., Herb. No. GUBH P28.

Only one species of *Sirosporium* Bubak & Serebrianikow is reported on the host genus *Carissa*. Our isolates showed similarity with *S. carissae*.

143. *Spiralum helicosporum* J.L. Mulder, 1975. *Trans. Br. mycol. Soc.* 65(3): 518

(Fig.143a-c; 143d)

Fungus Hyphomycete. *Leaf spots* amphigenous, large, circular, sometimes with concentric rings, 3-24 mm in diam., only one or two spots were observed on each leaf. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, slender, thin walled, smooth, hyaline, branched, 2-3.5 µm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, in dense fascicles, erect, straight to slightly flexuous, spiral, unbranched, septate, smooth, brown, 160-220 x 3-4.5 µm. *Conidiogenous cells* polyblastic, terminal later becoming intercalary, sympodial, cicatrized, 30-52.5 x 3-4 µm, scars minute, unthickened, not darkened. *Conidia* solitary, simple, hyaline, smooth, pluriseptate, spiral, 150-180 x 2-4 µm.

Specimen examined: On living leaves of *Psychotria dalzellii* Hook. (Rubiaceae), Cotigao, Cancona Goa, 16-08-03, Pratibha, J., Herb. No. GUBH P61.

Only two species of *Spiralum* are known so far and both were recorded as foliicolous.

Fig. 142a-c: *Sirosporium carissae*

142a- Leaf spots

142b- Conidiomata

142c- Conidium

Fig. 143a-c: *Spiralum helicosporum*

143a- Leaf spots

143b- Conidiomata

143c- Conidia

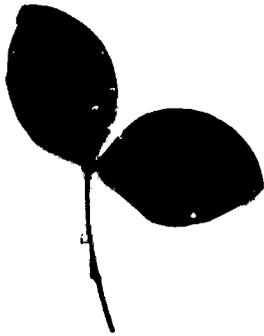
Fig. 144a-c: *Spiropes capensis*

144a- Leaf spots

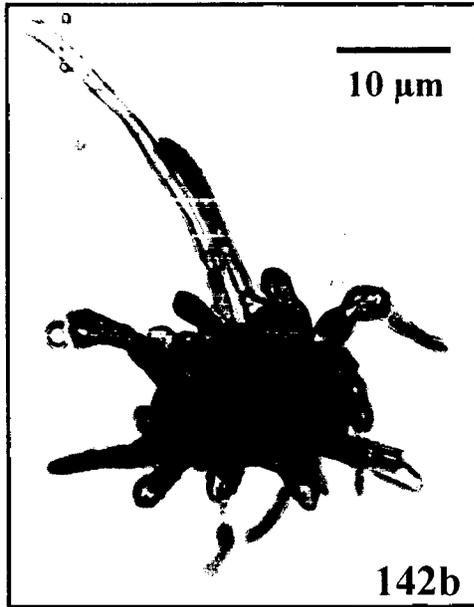
144b- Conidiomata

144c- Conidium

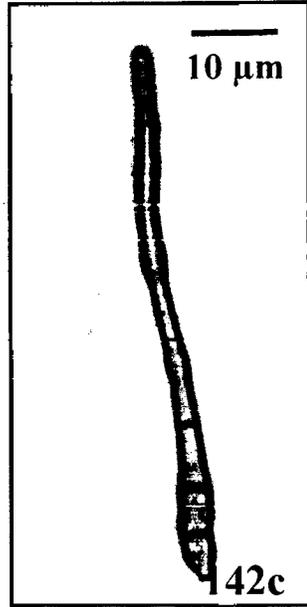
Fig. 142 -144



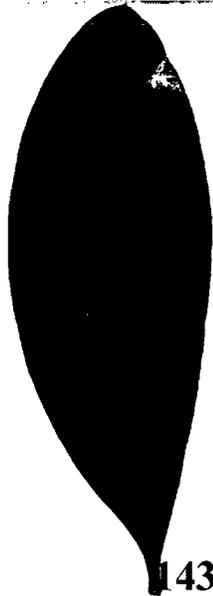
142a



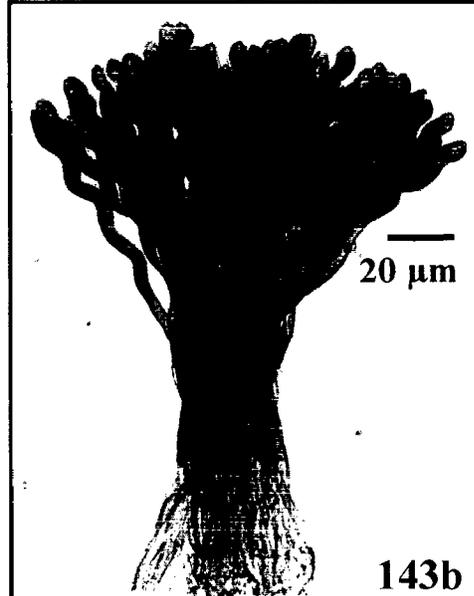
142b



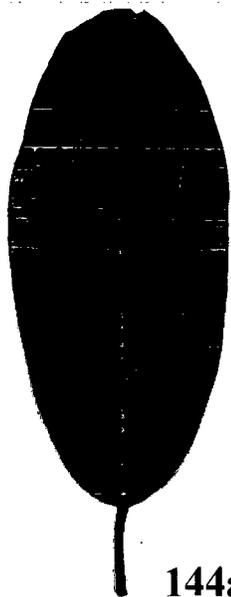
142c



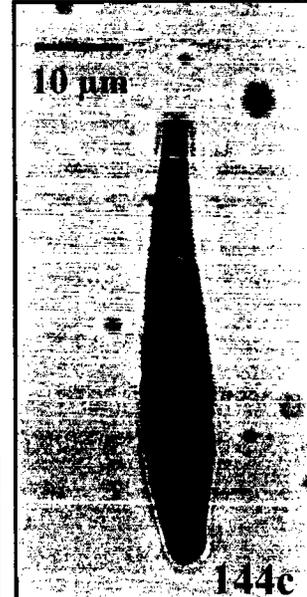
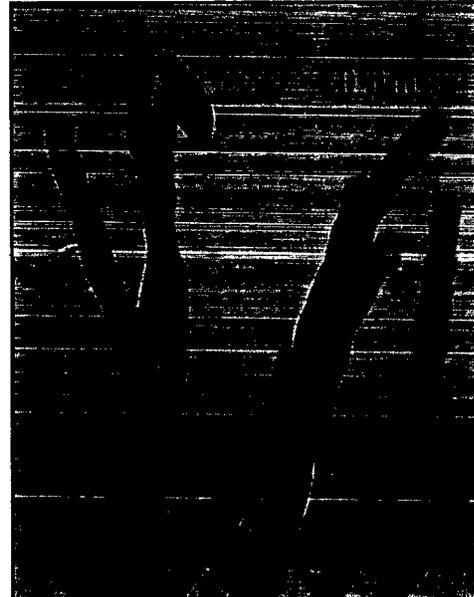
143a



143b



144a



144c

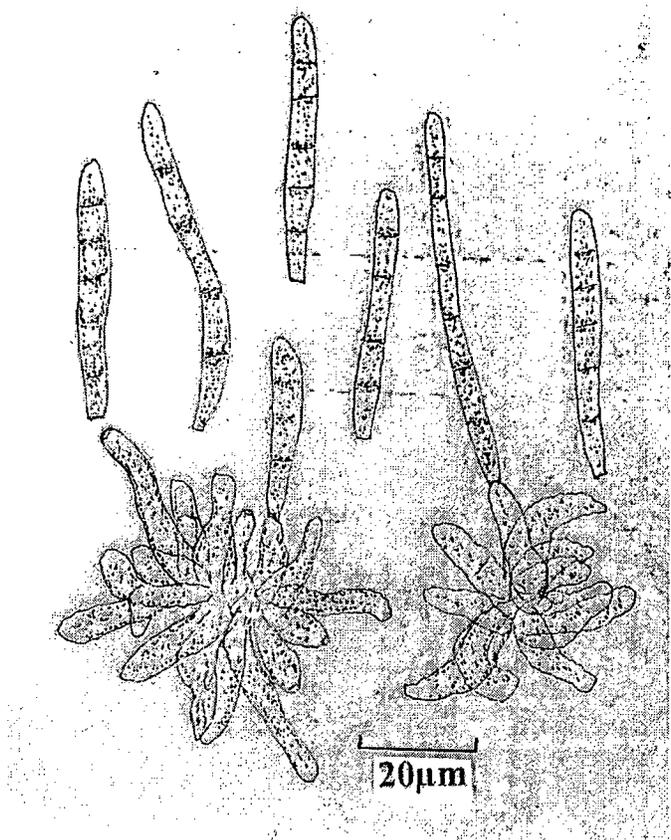


Fig.142d *Sirosporium carissae*

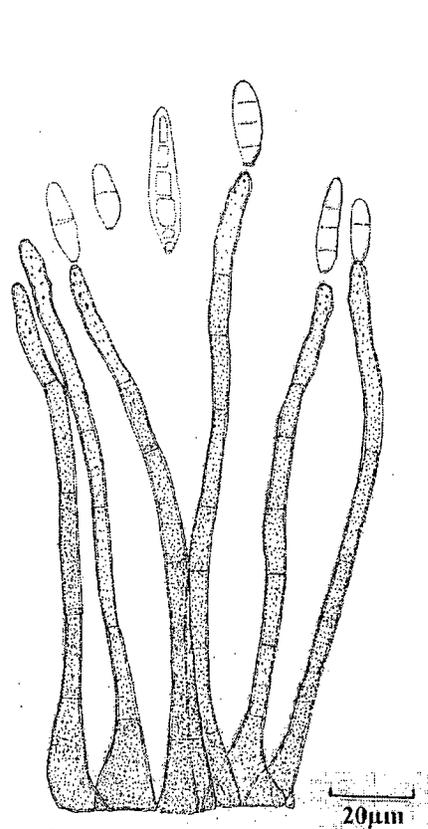


Fig. 144d *Spiropes capensis*

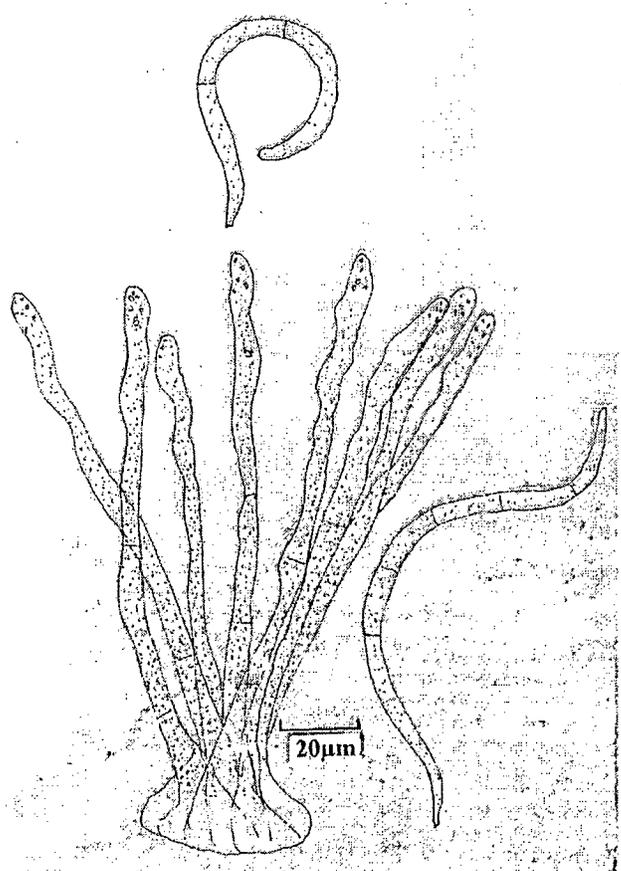


Fig. 143. *Spiralum helicosporum*

144. *Spiropes capensis* (Thüm.) M.B. Ellis, 1968. *Mycol. Pap.* 114: 5

(Fig.144a-c; 144d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular. *Colonies* on leaf spots effuse, dark brown, velvety. *Mycelium* partly immersed, partly superficial, composed of hyaline, smooth, branched, septate, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, unbranched, septate, smooth, thick walled, dark brown, 200-350 x 6-9 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, sympodial, smooth, cicatrized, 8-11 x 2-3 μm , with numerous conspicuous scars. *Conidia* solitary, simple, dry, acropleurogenous, olivaceous brown, smooth, truncate at the base, sub-acute at the apex, 3-5-septate, 35-60 x 8-11 μm .

Specimen examined: On living leaves of *Ficus asperrima* Roxb. (Moraceae), Nanoda, Sattari, Goa, India, 21/01/05, Ashish, P., Herb. No. GUBH P216.

This is the first record of the fungus from the forests of Western Ghats, India.

145. *Spiropes clavatus* (Ellis & G. Martin) M.B. Ellis, 1968. *Mycol. Pap.* 114: 25

(Fig.145a-c)

Fungus Hyphomycete. *Lesions* epigenous, circular, dark brown to black, 3-5 mm in diameter, spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, synnematous, threads very tightly packed together to form erect dark, brown, unbranched, 360-570 x 15-20 μm long synnema. single thread unbranched, dark brown, wavy, 2- 3.5 μm thick. *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, sympodial, cicatrized. *Conidia* solitary, dry, acropleurogenous, simple, smooth, obclavate, rounded at the

apex, truncate at the base, straight, light brown, 1-3 septate, thick-walled, 20-40 x 4-6.5 μm .

Specimen examined: On living leaves of *Memecylon* sp. (Melastomataceae) Chorla, Sattari, Goa, 02/07/04, Pratibha, J., Herb. No. GUBH P144.

This is the first record of the fungus from the forests of Western Ghats, India.

146. *Spiropes guareicola* (F. Stevens) Cif., 1955. *Sydowia* 9: 303 (Fig.146a-c; 146d)

Fungus Hyphomycete. *Lesions* amphigenous, black, circular, 4-5 mm in diameter, spreading on entire leaf surface on almost all the leaves of the plant. *Colonies* on leaf spots effuse, dark brown to black, velvety. *Mycelium* superficial composed of branched, septate, smooth, olivaceous branched, 2-3.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, dark brown, 140-215 x 6-9 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, sympodial, cicatrized, brown, scars numerous, conspicuous, thickened and darkened. *Conidia* solitary, simple, acropleurogenous, smooth, olivaceous brown, obclavate, 3-septate, truncate at the base, acute at the tip, 30-40 x 9-12.5 μm .

Specimen examined: On living leaves of *Citrus* sp. (Rutaceae), Shigao, Sanguem, Goa, 3108/04, Puja, G., Herb. No. GUBH P170; Culture No. GUFCC No. 4939.

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 0.9 cm in 7 days, circular, flat, slimy, light brown, margin smooth, reverse colourless.

This is the first record of *S. guareicola* from India and the Western Ghats.

147. *Spiropes helleri* (F. Stevens) M.B. Ellis, 1968. *Mycol. Pap.* 114: 14 (Fig.147a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, off dark brown, irregular, 5-8

Fig. 145a-c: *Spiropes clavatus*

145a- Leaf spots

1345b- Conidiomata

145c- Conidia

Fig. 146a-c: *Spiropes guareicola*

146a- Leaf spots

146b- Conidiomata

146c- Conidia

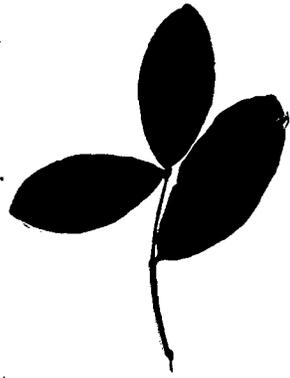
Fig. 147a-c: *Spiropes helleri*

147a- Leaf spots

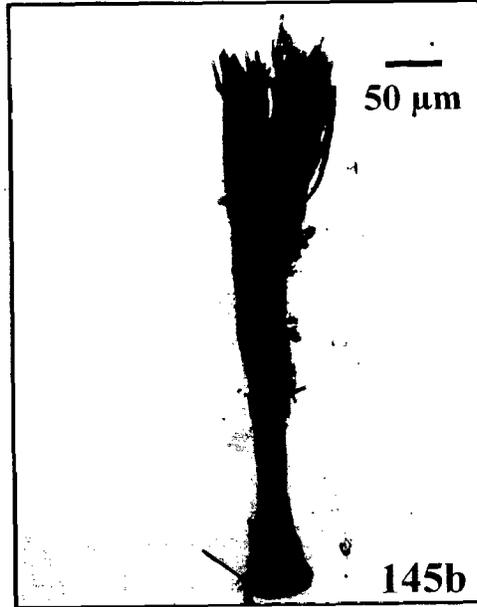
147b- Conidiomata

147c- Conidia

Fig. 145 -147



145a



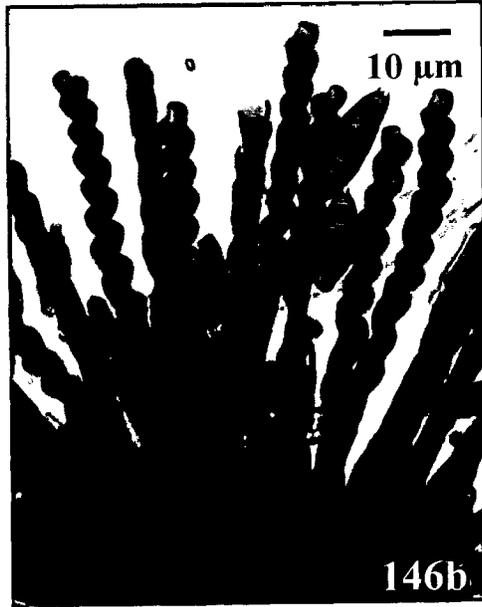
145b



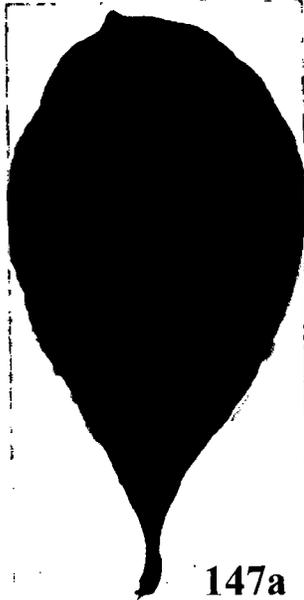
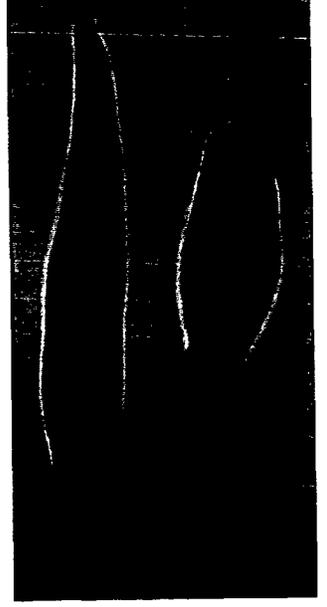
145c



146a



146b



147a



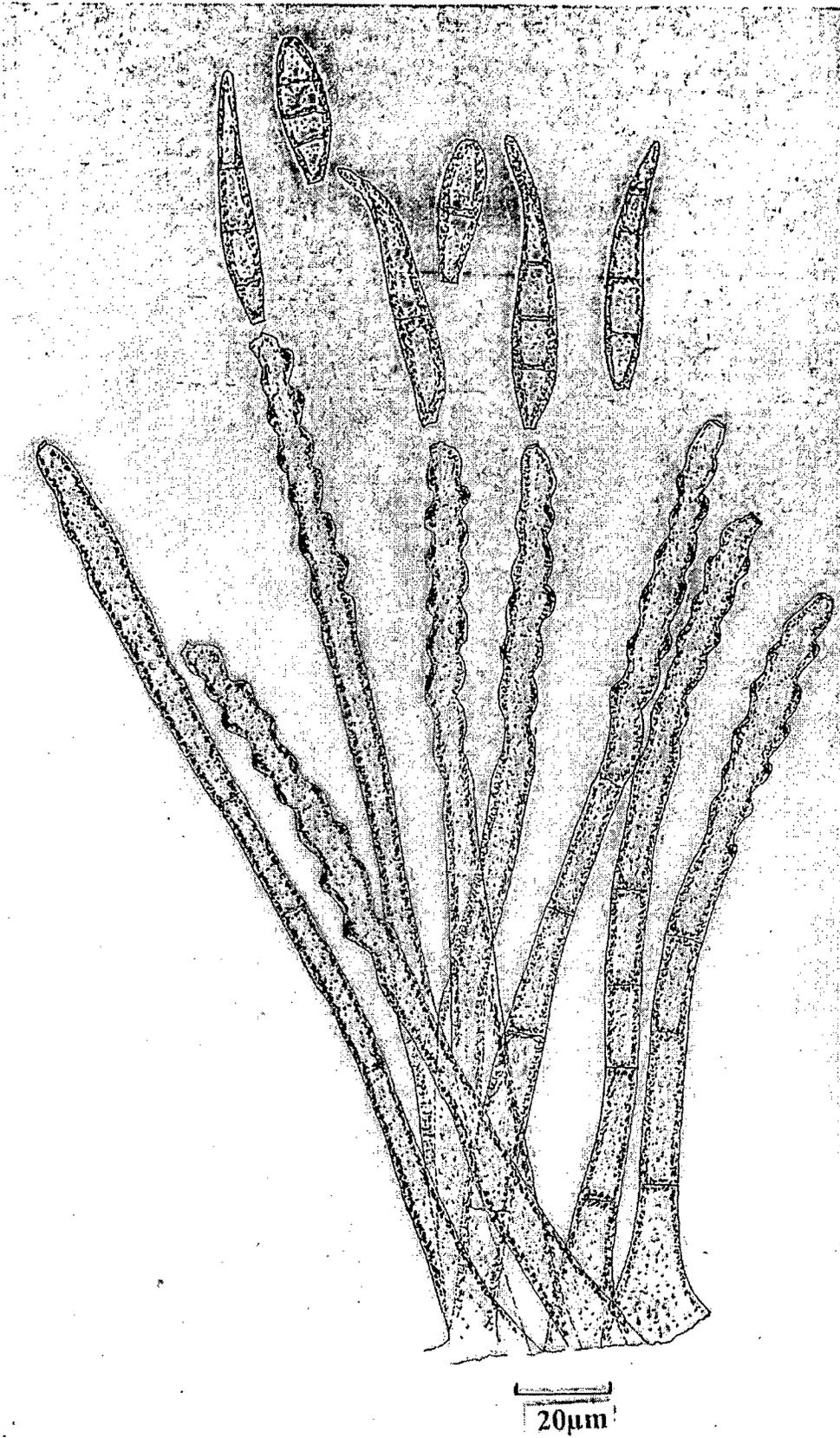


Fig. 146d *Spiropes guareicola*

mm wide. *Colonies* on leaf spots effuse, dark brown to black, hairy, sometimes growing superficially on Meliolales. *Mycelium* superficial, composed of sub-hyaline, smooth, branched, septate, 2.5-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, unbranched, septate, brown, thick-walled, 130-320 x 4-6.5 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, sympodial, cicatrized, 9-23 x 5-7 μm , scars numerous conspicuous. *Conidia* solitary, simple, straight, acropleurogenous, smooth, 2-3 septate, obclavate, sub-acute at the apex, truncate at the base, olivaceous brown, terminal cell sub-hyaline, 20-30 x 6-9 μm .

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P202.

This is the first record of *S. hilleri* from India and the forests of Western Ghats.

148. *Spiropes* sp. 1

(Fig.148a-c; 148d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white to light brown, irregular, sometimes circular with concentric rings, 4-5 mm wide. *Colonies* on leaf spots effuse, dark brown to black, velvety. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, smooth, branched, septate, 2.5-3.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, branched at the tip, septate, dark brown, thick-walled, 70-265 x 5-9 μm . *Conidiogenous cells* polyblastic, terminal later becoming intercalary, integrated, determinate, cicatrized, sympodial, 9-23 x 5-7 μm . *Conidia* solitary, simple, acropleurogenous, smooth, olivaceous brown,

1-2 septate, obclavate, rounded at the apex, truncate at the base, straight, 16-25 x 5-9 μm .

Specimen examined: On living leaves of *Lagestroemia* sp. (Lythraceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P85.

This unidentified taxon of *Spiropes* is reported *Lagestroemia* sp.

149. *Spiropes* sp. 2

(Fig.149a-c; 149d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, circular to irregular, 4-6 mm wide. *Colonies* on leaf spots effuse, dark brown to black, velvety. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, smooth, branched, septate, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, smooth, unbranched septate, dark brown, thick-walled, 80-150 x 4-6 μm . *Conidiogenous cells* polyblastic, terminal, later becoming intercalary, integrated, determinate, cicatrized, sympodial, 6-10 x 3-5 μm . *Conidia* solitary, simple, acropleurogenous, smooth, olivaceous brown, 1-2 septate, obclavate, truncate at the base, straight, with hyaline terminal cell, 15-22 x 4-6 μm .

Specimen examined: On living leaves of *Diospyrus* sp. (Ebenaceae) Yana, Uttar Kanada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P208.

Till date, 35 species of *Spiropes* are recorded, both litter as well as foliicolous. Some of them were also associated with other leaf-inhabiting fungi such as *Meliola* (Ellis, 1971, 1976).

150. *Sporidesmium adscendens* Berk., 1840. Ann. Mag. nat. Hist. 4: 291

(Fig.150a-c; 150d)

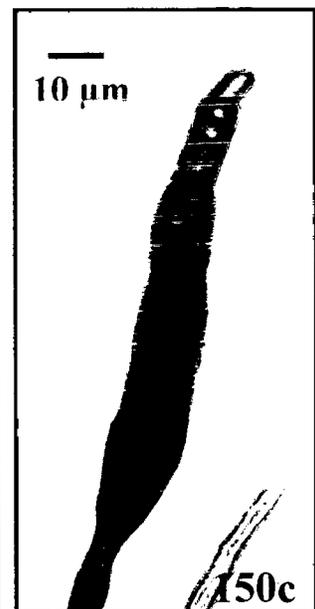
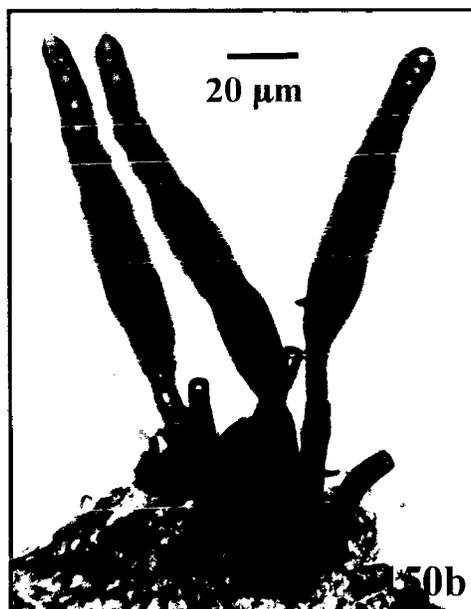
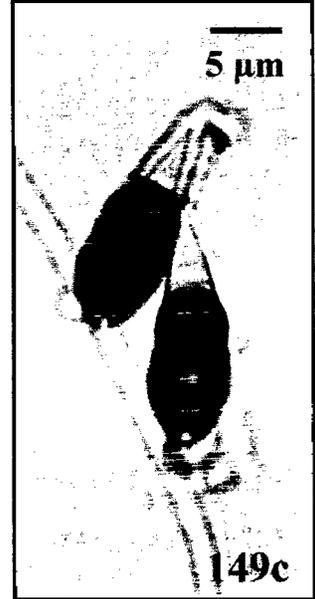
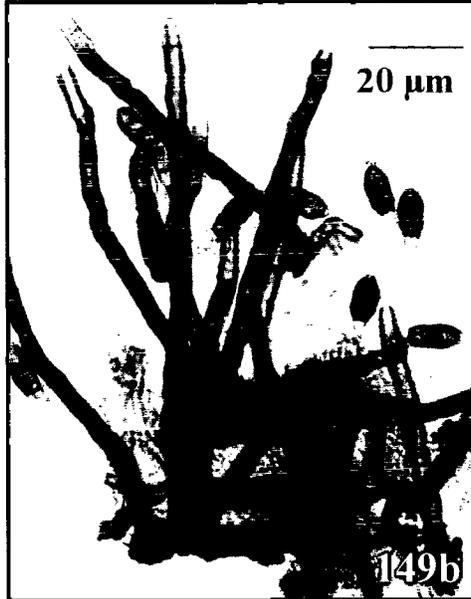
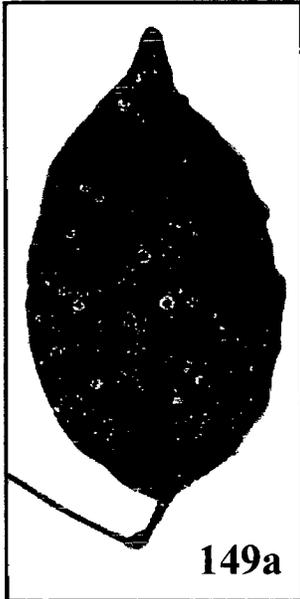
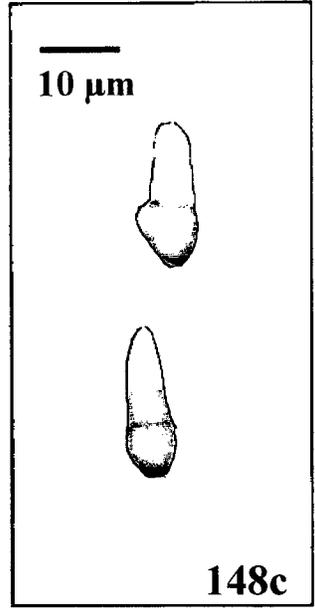
Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown to black, 5-6 mm wide, spreading on entire leaf surface. *Colonies* on leaf spots effuse,

Fig. 148a-c: *Spiropes* sp. 1
148a- Leaf spots
148b- Conidiomata
148c- Conidia

Fig. 149a-c: *Spiropes* sp. 2
149a- Leaf spots
149b- Conidiomata
149c- Conidia

Fig. 150a-c: *Sporidesmium adscendens*
150a- Leaf spots
150b- Conidiomata
150c- Conidium

Fig. 148-150



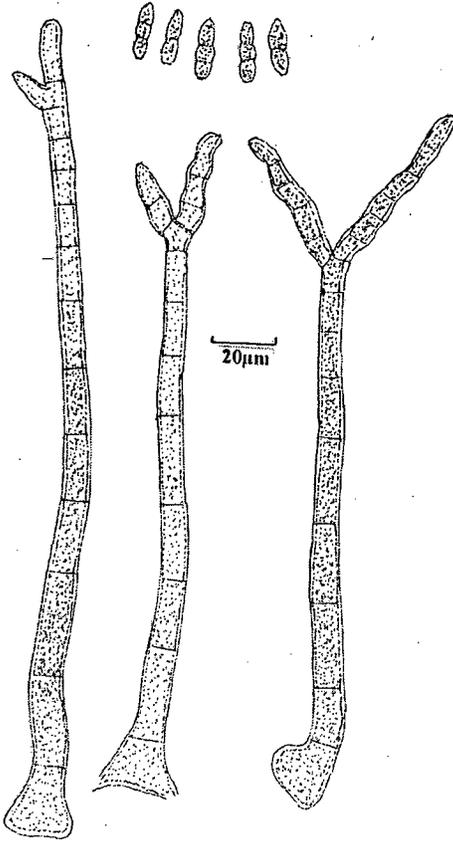


Fig. 148d *Spiropes* sp.

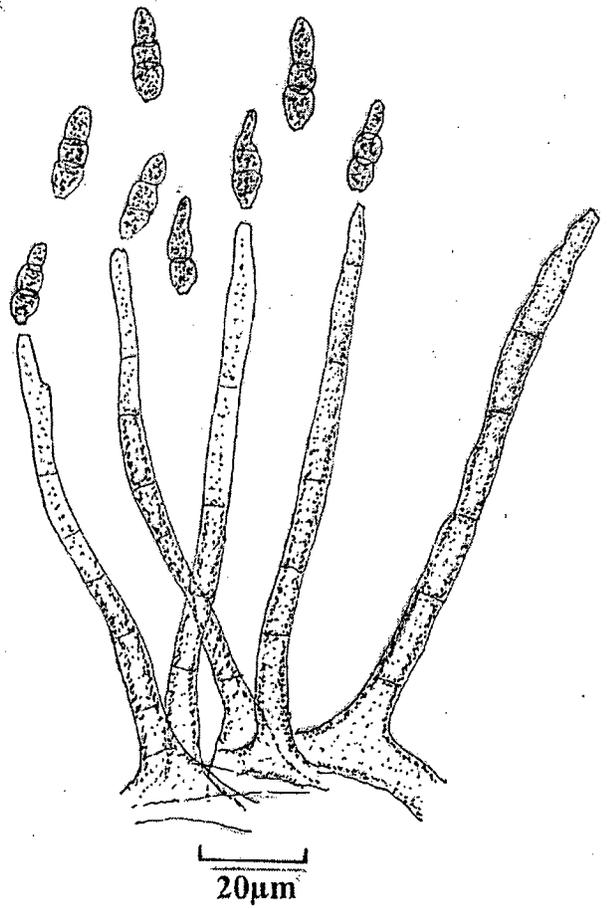


Fig. 149d *Spiropes* sp

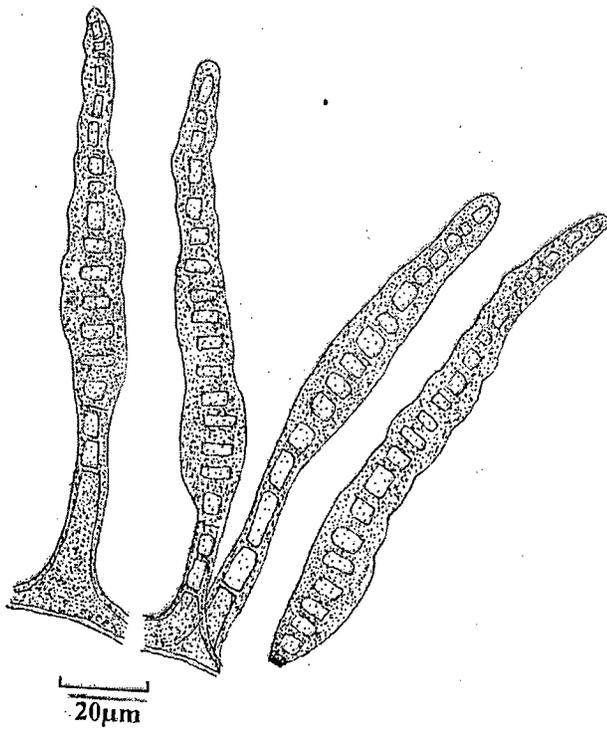


Fig. 150d *Sporidesmium adscendens*

dark brown to almost black, velvety. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, dark brown, 27-55 x 4-7 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, 6-9 x 4-6 μm . *Conidia* solitary, simple, acrogenous, dark brown, smooth, straight, 10-16 distoseptate, truncate at the base, rounded at the tip, 45-150 x 15-20 μm .

Specimen examined: On living leaves of *Ixora coccinea* Linn. (Rubiaceae), Valpoi, Sattari Goa, 19/02/04, Pratibha, J., Herb. No. GUBH P123.

A number of species of *Sporidesmium* are known (Ellis, 1971, 1976; Matsushima, 1971, 1975). However, all these are well known lignicolous fungi. *S. ascendens*, for the first time, described here as foliicolous.

151. *Sporodesmium coronatum* Fuckel, 1874. *Symb. Mycol. Nachtrag.* 27-28: 77

(Fig.151a-c; 151d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, circular to semi-circular, 1-1.5 mm wide, with yellow halo around the spots. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, erect, straight to flexuous, unbranched, 1-3 septate, dark brown, smooth, 18-55 x 3.5-5 μm . *Conidiogenous cells* monoblastic, integrated, terminal, determinate, 9.5-15.5 x 3.5-5 μm . *Conidia* solitary, simple, acrogenous, straight, light brown, pluriseptate, smooth, pointed at the tip, truncate at the base, 28.5-48.5 x 7.5-12.5 μm .

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P76.

S. coronatum, for the first time, described here as foliicolous.

152. *Sporidesmium* sp.

(Fig.152a-c; 152d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white to gray, irregular, 3-4 mm wide. *Colonies* on leaf spots effuse, dark brown to almost black, velvety. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, dark brown, 23-52 x 3-5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, 10-18 x 3-5 μm . *Conidia* catenate, simple, acrogenous, dark brown, smooth, thick-walled, straight, 1-septate, obclavate to sub-cylindrical, truncate at the base, sub-acute to rounded at the tip, 19-28 x 3-5 μm .

Specimen examined: On living leaves of *Calamus* sp. (Arecaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P98.

So far, 430 species are known in the genus *Sporidesmium* Link is typified by *S. atrum*. Most of them are true litter inhabiting fungi (Ellis, 1971; 1976). Above yet to be identified species of the genus is recorded as foliicolous.

153. *Stachybotrys kampalensis* Hansf., 1943. *Proc. Linn. Soc. London* 155: 45

(Fig.153a-c; 153d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown with dark brown margin, later turning black, mostly observed at the tip of the leaf. *Colonies* on leaf spots effuse, black, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight, unbranched, septate, smooth, sub-hyaline, bearing a group of phialides at the apex, 80-110 x 6-9.5 μm . *Conidiogenous cells* monopialidic, terminal, discrete, in a group of five, sub-hyaline, smooth, thick-walled, 11.5-17.5 x 4-6 μm . *Conidia* solitary, simple, dark brown to almost black, aseptate, oblong, rounded at

Fig. 151a-c: *Sporodesmium coronatum*

151a- Leaf spots

151b- Conidiomata

151c- Conidiophore and conidia

Fig. 152a-c: *Sporidesmium* sp.

152a- Leaf spots

152b- Conidiomata

152c- Conidia

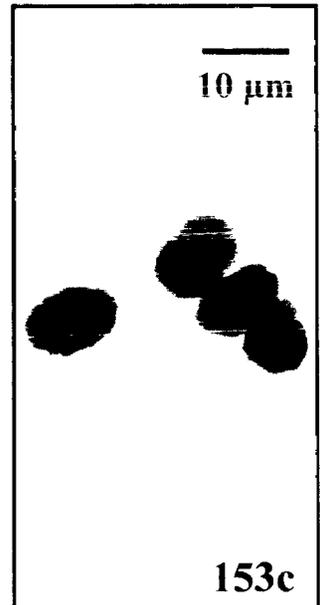
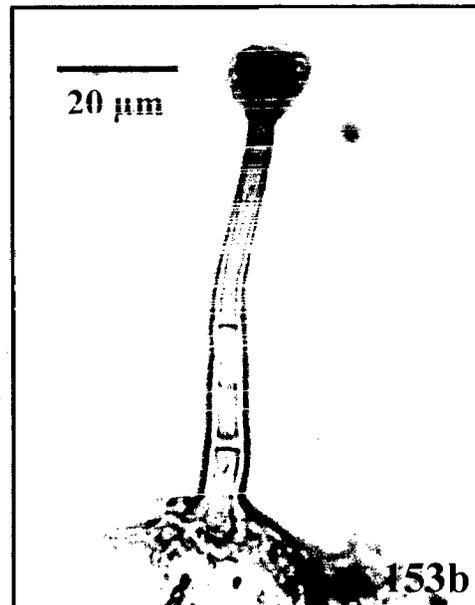
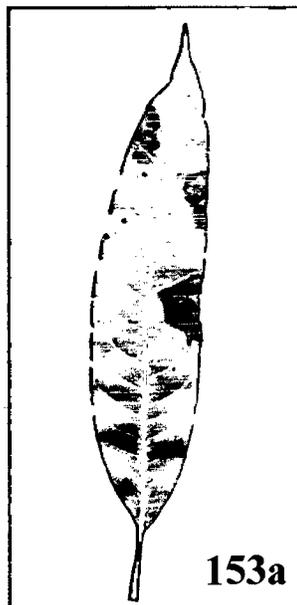
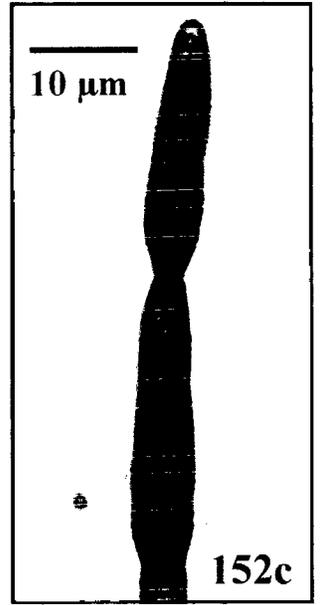
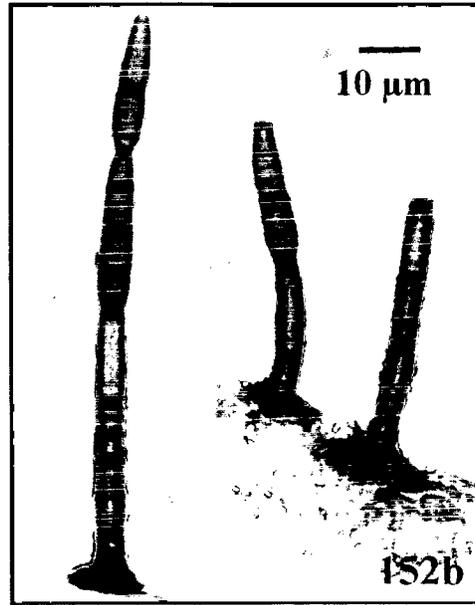
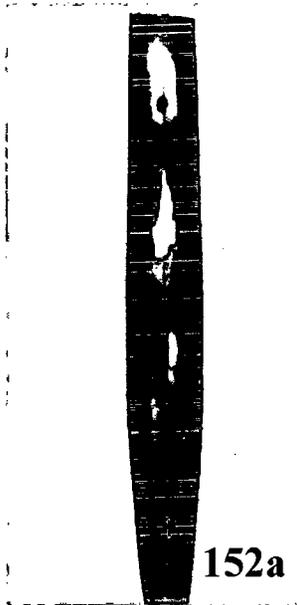
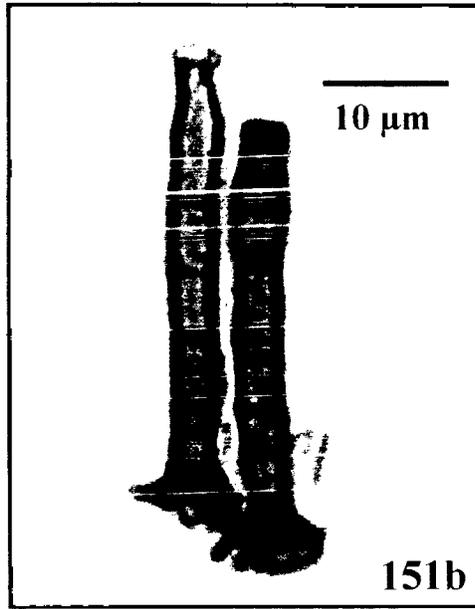
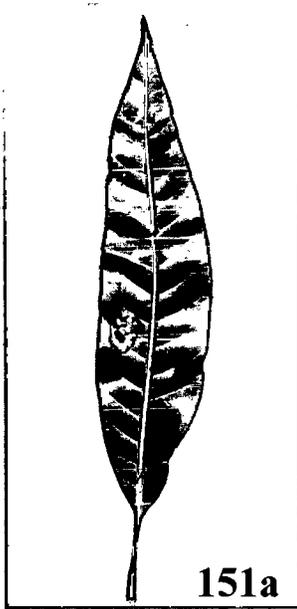
Fig. 153a-c: *Stachybotrys kampalensis*

153a- Leaf spots

153b- Conidiomata

153c- Conidia

Fig. 151-153



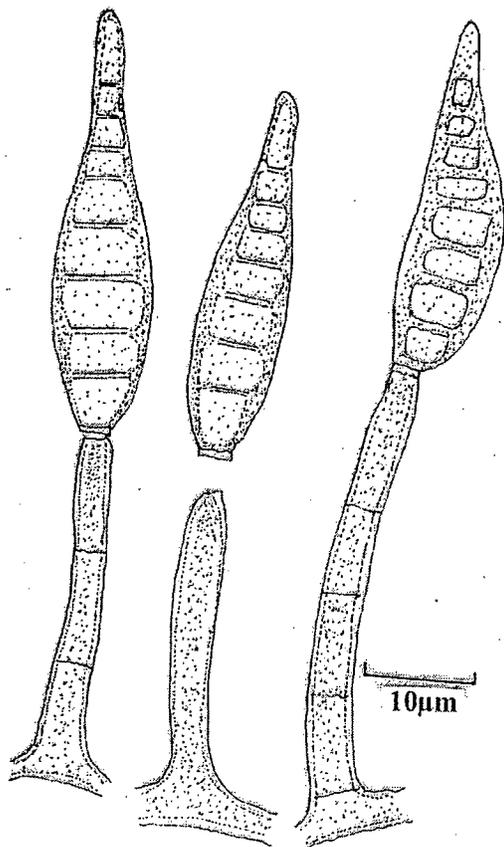


Fig. 151d *Sporodesmium*
coronatum

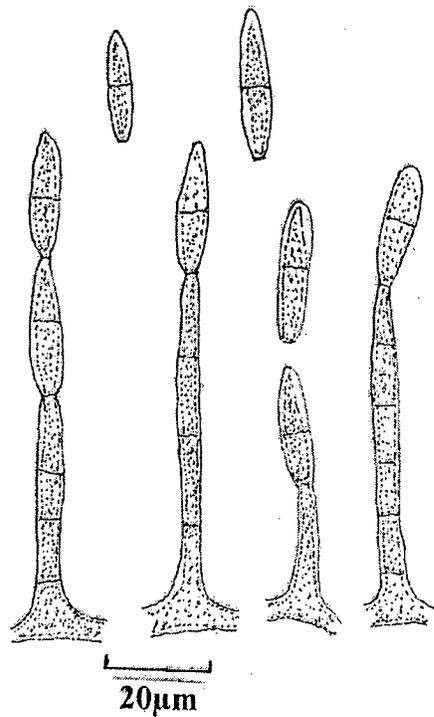


Fig. 152d *Sporidesmium* sp.

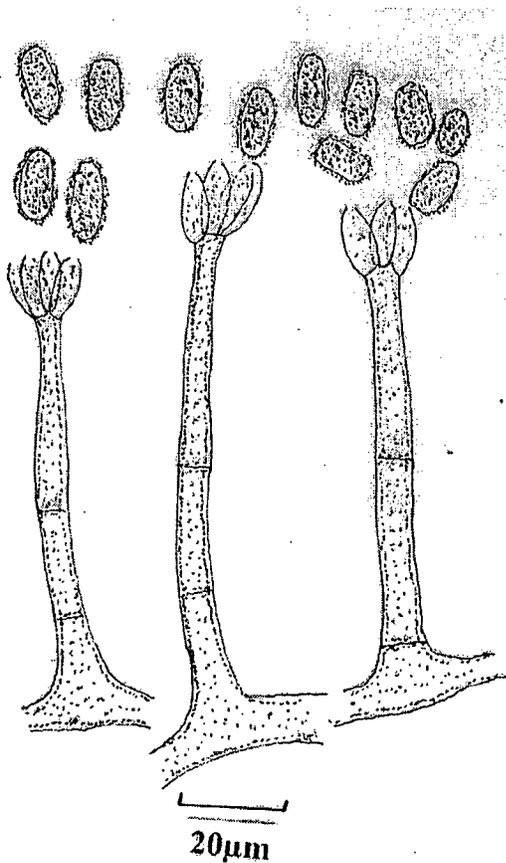


Fig. 153d *Stachybotrys kampalensis*

both the ends, verrucose, in slimy black heads at the tip of phialide, 9.5-13.5 x 5-7.5 μm .

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Valpoi, Sattari Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P44; Culture No. GUFCC No. 4940.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 3.4 cm in 7 days, circular, cottony, off-white with light green spore heads, margin smooth, reverse off-white.

Species of *Stachybotrys* are well-known litter fungi (Ellis, 1971; 1976) and *S. kampalensis* has been reported for the first time as foliicolous.

154. *Stenella smilacis* P. Kumar, D.N. Shukla & Kamal, 1980. *Curr. Sci.* 49(6): 234
(Fig.154a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, semi-circular to irregular, pale brown with black spot in the center, up to 15 mm in wide. *Colonies* on leaf spots effuse, dark brown. *Mycelium* partly immersed, partly superficial, composed of light olivaceous, verrucose, branched, septate, 2.5-4.5 μm wide hyphae. *Stroma* parenchymatous, brown, 30-40 μm in diam. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary as well in group of 5-7, erect, straight to slightly flexuous, unbranched, septate, brown, smooth, 60-315 x 2.5-5 μm , arises from stroma as well as superficial hyphae, conidiophores arising from superficial hyphae solitary, light yellow; conidiophores arising from stroma fasciculate, brown. *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, conspicuously cicatrized, highly geniculate, 20-60 x 2-5 μm . *Conidia* solitary, as well as catenate, dry, simple, pale brown, verrucose, 0-3 septate, truncate at the base, rounded at the apex, 17-70 x 3-6 μm .

Specimen examined: On living leaves of *Smilax zeylanicus* Linn. (Smilacaceae), Banastari, Ponda Goa, 07/01/03, Herb. No. GUBH P6; Mashem, Canacona Goa, 16/10/04, Herb. No. GUBH P6; Polem, Canacona Goa, 26/10/04, Herb. No. GUBH P6; Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P6.

Only one species of *Stenella* Sydow, *S. smilacis*, is so far reported from the host genus *Smilax*. The fungus was isolated from 4 different localities from the same host, which indicate its host specificity.

155. *Stenella* sp. 1

(Fig.155a-c; 155d)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, irregular, 2-4 mm wide. *Colonies* effuse, brown. *Mycelium* partly immersed, partly superficial, composed of light olivaceous, verrucose, septate, branched, 2-2.5 μm wide hyphae; *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, septate, branched, light brown, verrucose, 11-350 x 3.5-5 μm , *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, cicatrized. *Conidia* solitary, simple, light olivaceous, verrucose, septate, truncate at the base, rounded at the apex, 100-128 x 3.5-4.5 μm .

Specimen examined: On living leaves of *Grewia microcos* Linn. (Tiliaceae), Valpoi, Sattari Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P47.

156. *Stenella* sp. 2

(Fig.156a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, irregular, 4-8 mm wide. *Colonies* on leaf spots effuse, dark brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin branched, light olivaceous, septate, verrucose, 1.5-2.5 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, dark brown, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, septate, 55-220 x 4-6 μm .

Fig. 154a-c: *Stenella smilacis*

154a- Leaf spots

154b- Conidiomata

154c- Conidium

Fig. 155a-c: *Stenella* sp. 1

155a- Leaf spots

155b- Conidiomata

155c- Conidia

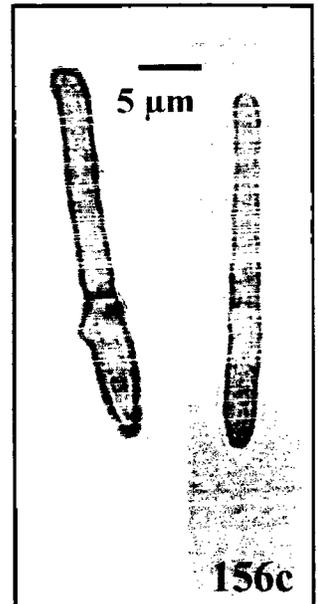
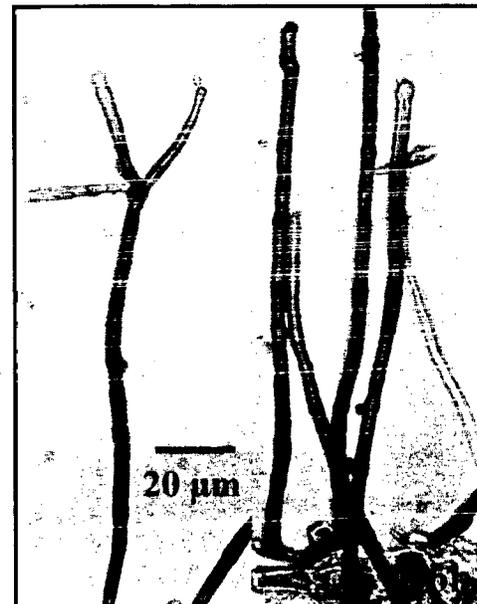
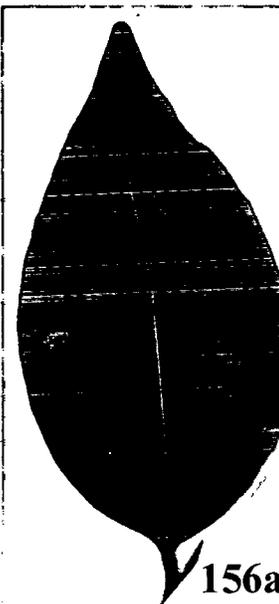
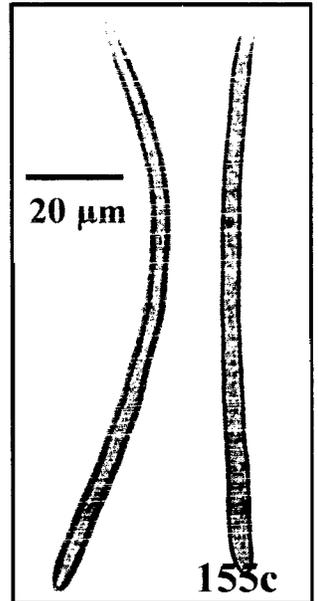
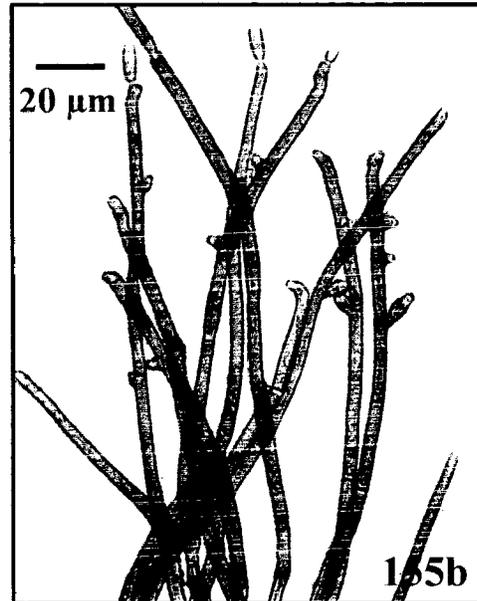
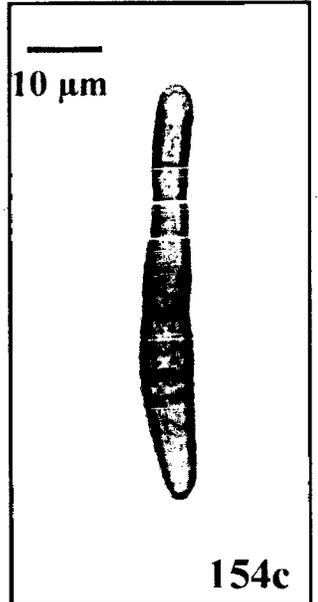
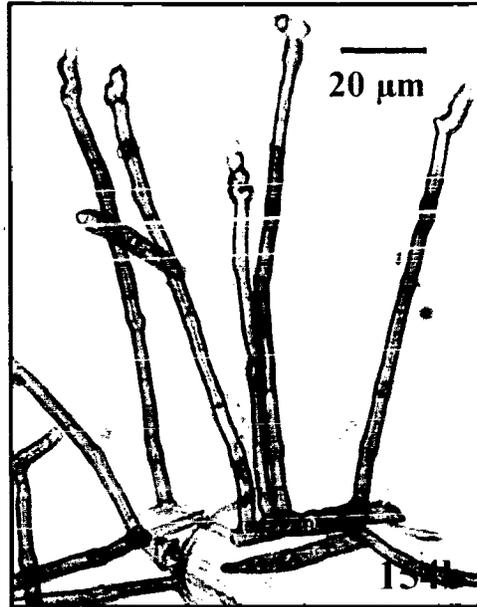
Fig. 156a-c: *Stenella* sp. 2

156a- Leaf spots

156b- Conidiomata

156c- Conidia

Fig. 154-156



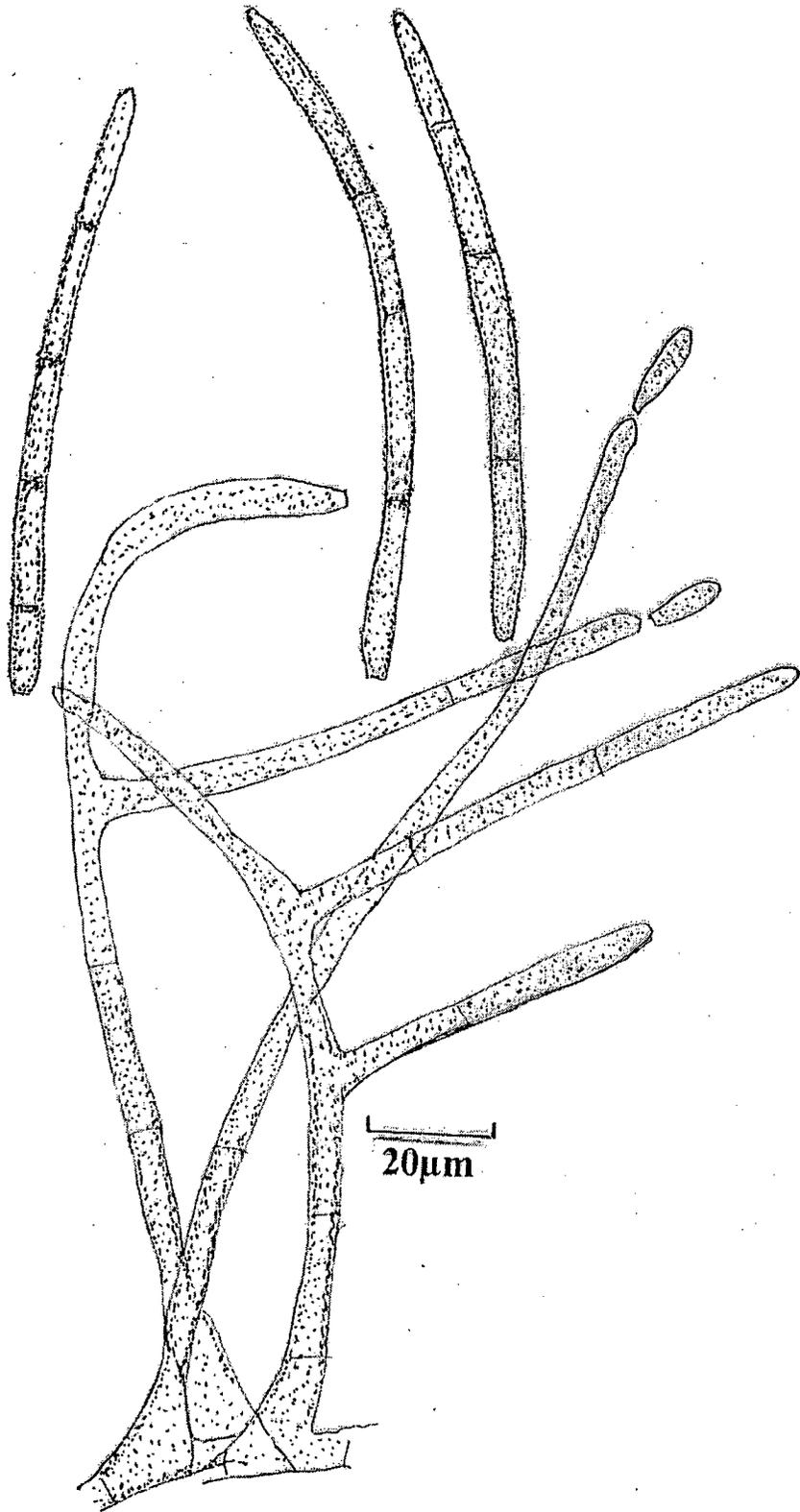


Fig. 155d *Stenella* sp. 1

Conidiogenous cells polyblastic, terminal, determinate, integrated, denticulate, sub-hyaline, sympodial. *Conidia* solitary, simple, acropleurogenous, light olivaceous, 0-1-septate, verrucose, 12-18-25 x 2-3 μm .

Specimen examined: On living leaves of *Strychnos nux-vomica* Linn. (Loganiaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P190.

157. *Stenella* sp. 3

(Fig.157a-c; 157d)

Fungus Hyphomycete. *Leaf spots* amphigenous, grayish brown, irregular, 3-5 mm wide. *Colonies* on leaf spots effuse, dark green, hairy. *Mycelium* partly immersed, partly superficial, composed of thin branched, light olivaceous, septate, verrucose, 1.5-2.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, dark brown, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, rarely branched at the tip, septate, 150-230 x 3-4.5 μm . *Conidiogenous cells* polyblastic, terminal, determinate, integrated, denticulate, sub-hyaline, sympodial, 30-55 x 3-4 μm ; conidial scars unthickened, not darkened. *Conidia* solitary, simple, acropleurogenous, sub-hyaline, pluriseptate, scolecosporous, filiform, smooth, 12-63 x 2.5-4.5 μm ; hilum unthickened, not darkened.

Specimen examined: On living leaves of *Vitex* sp. (Verbenaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P199; Culture No. GUFCC No. 4941.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 1.3 cm in 7 days, cartilagenous, dark green, margin wavy, reverse black.

158. *Stenella* sp. 4

(Fig.158a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown, rectangular to

irregular, 2-5 mm wide. *Colonies* on leaf spots effuse, dark green, hairy. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, verrucose, branched, septate, 2-3 μm wide hyphae; *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, branched, septate, smooth, brown, thick-walled, 60-130 x 3-4.5 μm . *Conidiogenous cells* polyblastic, integrated, terminal, later becoming intercalary, determinate, sympodial, cicatrized with prominent, numerous scars. *Conidia* solitary, dry, simple, acropleurogenous, obclavate, olivaceous brown, 0-1-septate, verruculose, 14-22 x 3-4 μm .

Specimen examined: On living leaves of *Ixora* sp. (Rubiaceae), Cotiga, Cancona Goa, 13/02/04, Pratibha, J., Herb. No. GUBH P226.

The above 4 taxa of *Stenella* were not identified to down to species level due to lack of literature. Undoubtedly, these are distinguishable taxa within the genus.

159. *Stigmina mangiferae* (Koord.) M.B. Ellis, 1959. *Mycol. Pap.* 72: 49

(Fig.159a-c; 159d)

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, tiny, dark brown to black in the center with light brown margin, 1-2 mm in diameter. *Colonies* on leaf spots punctiform, dark brown to black, velvety. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, densely packed together to form a sporodochia, short, unbranched, straight to slightly curved, septate, smooth, light brown, 8-20 x 3-4.5 μm . *Conidiogenous cells* monoblastic, with annulations, terminal, determinate, integrated. *Conidia* solitary, simple, acrogenous, brown, paler towards the apex, smooth, straight to slightly curved, truncate at the base, rounded at the tip, 28-100 x 2-5 μm .

Fig. 157a-c: *Stenella* sp. 3

157a- Leaf spots

157b- Conidiomata

157c- Conidium

Fig. 158a-c: *Stenella* sp. 4

158a- Leaf spots

158b- Conidiomata

158c- Conidium

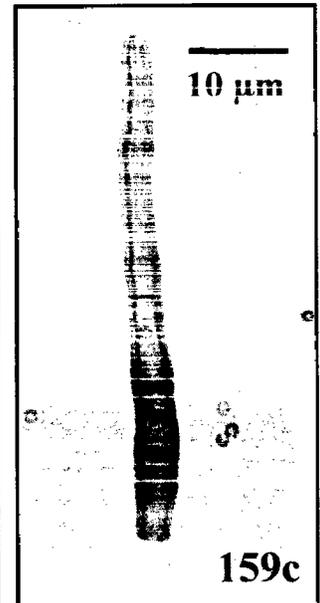
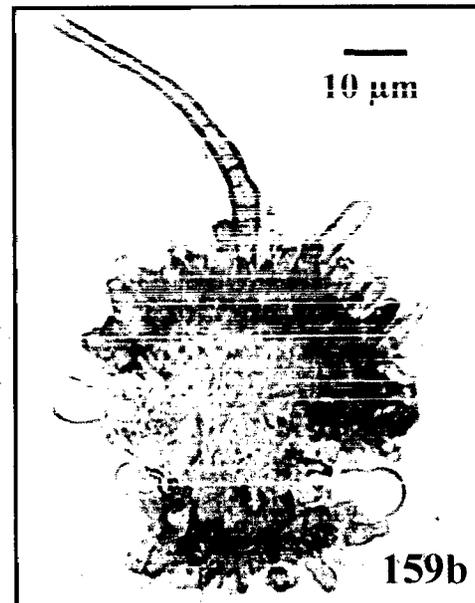
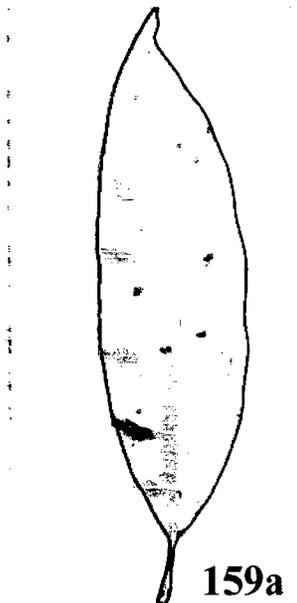
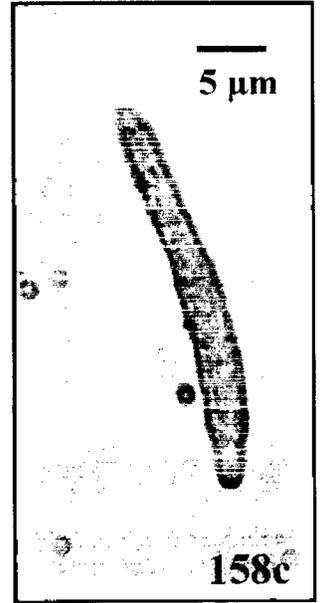
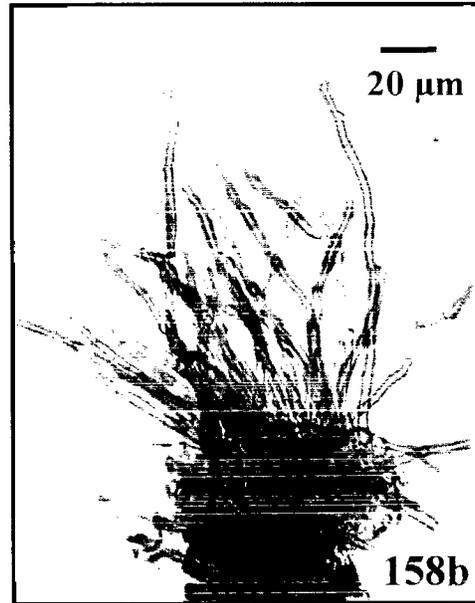
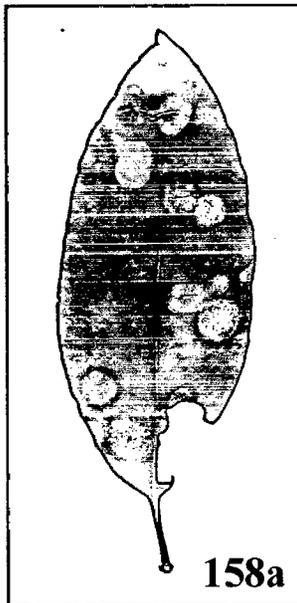
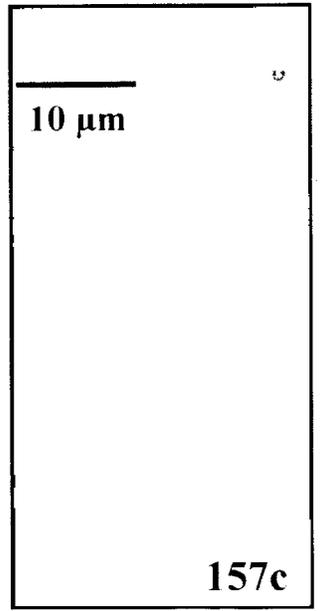
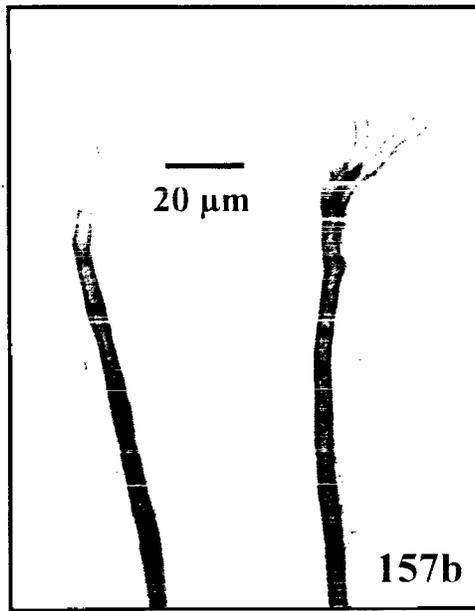
Fig. 159a-c: *Stigmina mangiferae*

159a- Leaf spots

159b- Conidiomata

159c- Conidium

Fig. 157-159



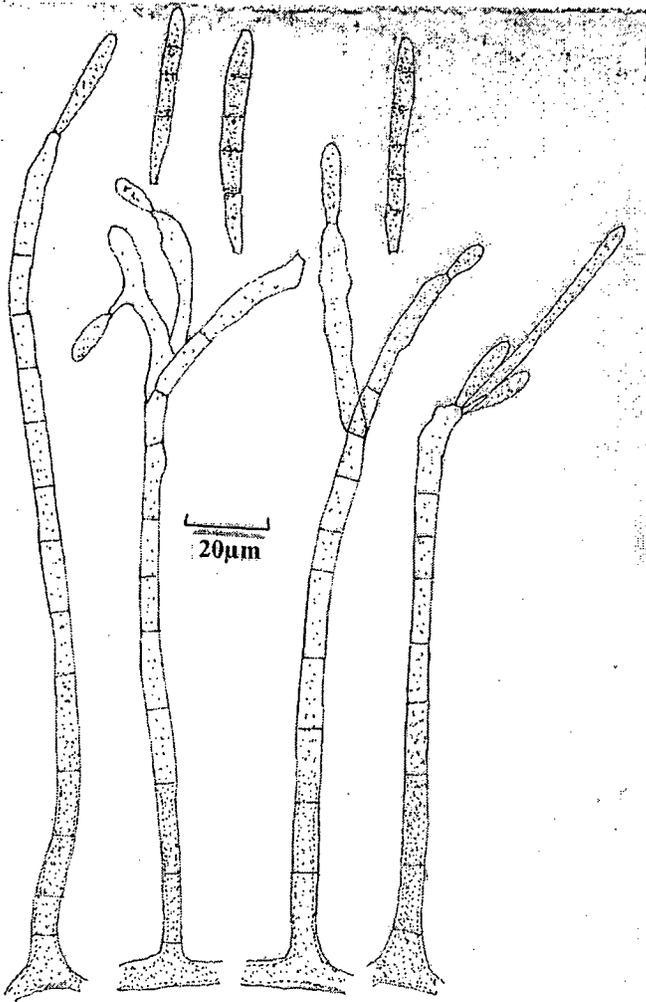


Fig. 157d *Stenella* sp. 3

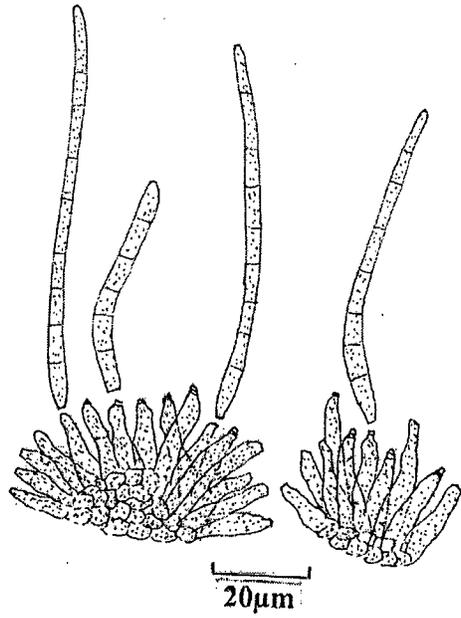


Fig. 159d *Stigmina mangiferae*

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Kodal, Sattari Goa, 17/03/04, Pratibha, J., Herb. No. GUBH P124; Paryem, Sattari Goa, 02/07/04, Herb. No. GUBH P124.

Only one species of *Stigmina*, *S. mangiferae*, is so far reported from the host genus *Mangifera*. The fungus was isolated from 2 different localities from the same host.

160. *Tomenticola* sp.

(Fig.160a-c; 160d)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular patch covering 20 mm wide area, only one spot was observed on few leaves of the tree. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, septate, branched, light olivaceous, 2-3.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, dark brown, erect, straight to slightly flexuous, smooth, thick-walled, unbranched, aseptate, 20-35 x 3-4.5 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, smooth, conico-truncate at the apex. *Conidia* solitary, simple, acrogenous, dark brown, straight to slightly curved, 4-6-septate, obclavate, conico-truncate at the base, rounded at the apex, smooth, 33-55 x 4-7 μm .

Specimen examined: On living leaves of *Strychnos nux-vomica* Linn. (Loganiaceae), Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P192; Culture No. GUFCC No. 4942.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 3.5 cm in 7 days, circular, flat, slimy, off-white, margin smooth, reverse colourless.

Genus Tomenticola Deighton, is typified by *T. trmetis*. So far only one species is described in the genus.

161. *Torula herbarum* (Pers.) Link, 1809. *Magazin Ges. naturf. Freunde, Berlin* 3: 19 (Fig.161a-c; 161d)

Fungus Hyphomycete. *Leaf spots* epigenous, irregular, dark green, a small patch growing along the margin of the few leaves on the tree. *Colonies* on leaf spots effuse, dark green to black, velvety. *Mycelium* partly immersed, partly superficial, composed of smooth, septate, branched, light brown, 2-4 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* semi-macronematous, mononematous, solitary, smooth, thick walled, brown, septate, unbranched, 6-9 x 5-8 μm . *Conidiogenous cells* polyblastic, terminal as well as intercalary, integrated, determinate, verrucose. *Conidia* catenate, dry, in branched chains, thick-walled, dark brown to black, acropleurogenous, ellipsoidal, rounded at both ends, 1-3-septate, constricted at the septum, verrucose, 20-35 x 4-9 μm .

Specimen examined: On living leaves of *Alstonia scholaris* (Linn.) R. Br. (Apocynaceae), GU campus, Tiswadi Goa, 27/07/04, Dr. M.K. Janarthanam, Herb. No. GUBH P162.

So far described all species of *Torula* Pers. ex Fr., are litter inhabitants. This is the first record of a species in the genus as foliicolous.

162. *Trichothecium* sp. (Fig.162a-c; 162d)

Fungus Hyphomycete. *Lesions* indistinct, colonies white, cottony, growing superficially on the surface of green leaves. *Colonies* on leaf spots effuse, white, cottony, growing superficially on the upper surface of leaf. *mycelium* superficial, composed of hyaline, thin walled, branched, septate, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, smooth, unbranched, septate, hyaline, 115-400 x 3-5 μm . *Conidiogenous cells* monoblastic, integrated, terminal,

Fig. 160a-c: *Tomenticola* sp.

160a- Leaf spots

160b- Conidiomata

160c- Conidia

Fig. 161a-c: *Torula herbarum*

161a- Leaf spots

161b- Catenate conidia

161c- Conidia

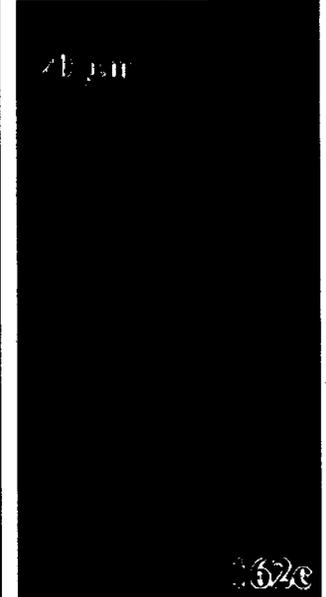
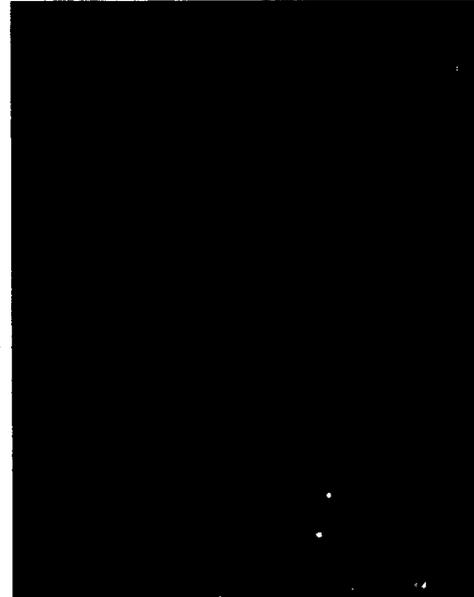
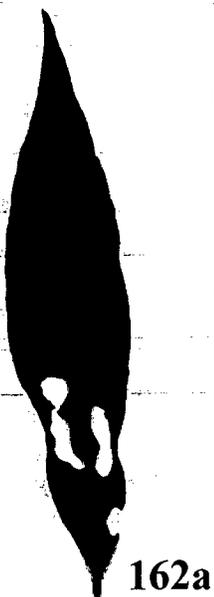
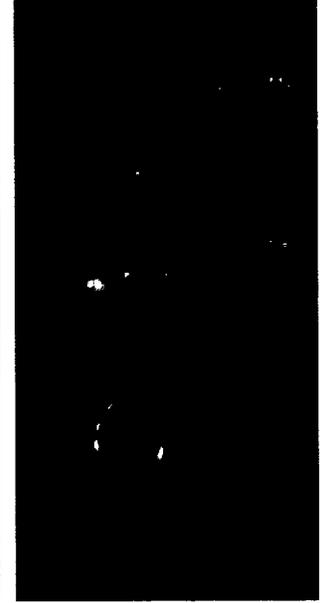
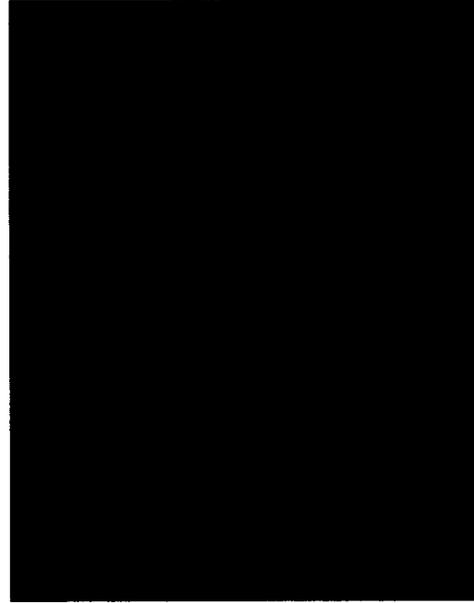
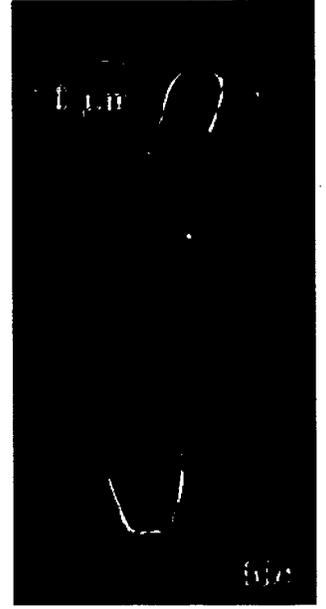
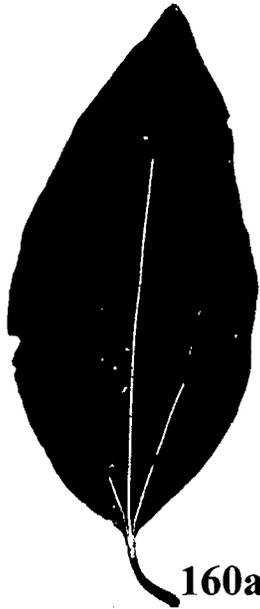
Fig. 162a-c: *Trichothecium* sp.

162a- Leaf spots

162b- Conidiomata

162c- Conidia

Fig. 160-162



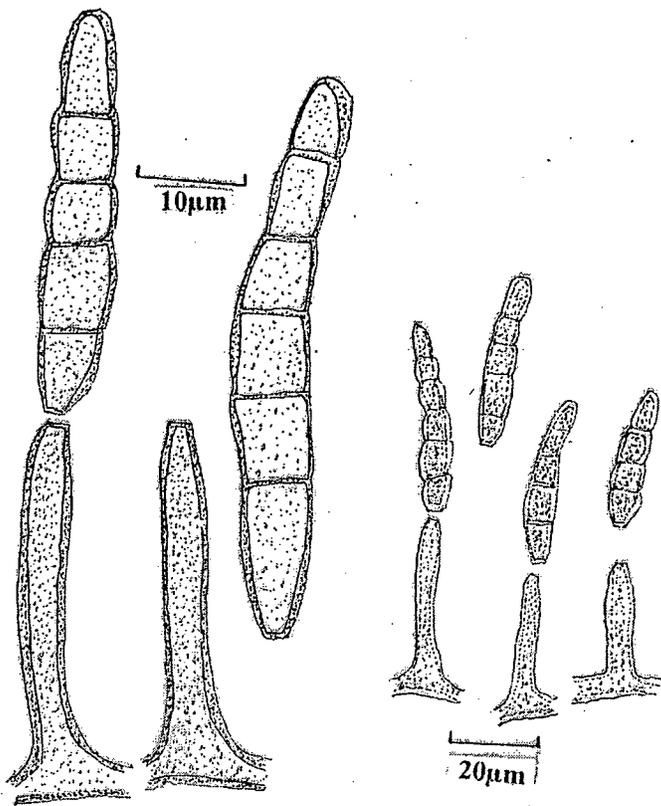


Fig. 160d *Tomenticola* sp.

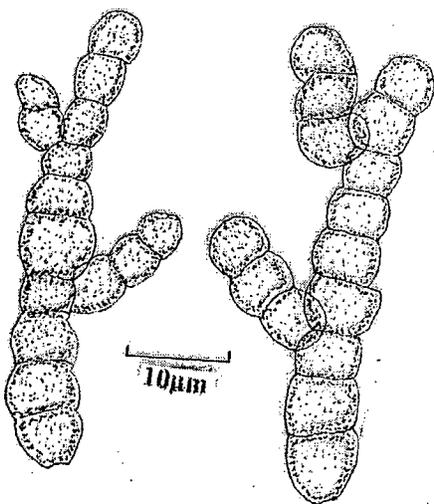


Fig. 161d *Torula herbarum*

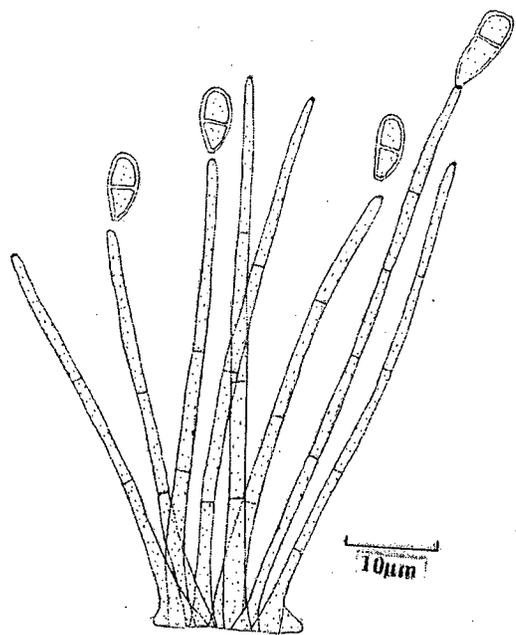


Fig. 162d *Trichothecium* sp.

determinate, hyaline, 25-35 x 3.5-5 μm . *Conidia* solitary, simple, hyaline, smooth, 1-septate, rounded at the apex, truncate at the base, 23-30 x 10-18 μm .

Specimen examined: On living leaves of *Syzygium cumini* Linn. (Myrtaceae), Banastari, Ponda Goa, 19/02/03, Pratibha, J., Herb. No. GUBH P16.

All species in the genus *Trichothecium* Link are litter inhabitants (Matsushima, 1975; Hawksworth, 2001). This is the first report of a species in the genus as foliicolous.

163. *Vermiculariopsiella elegans* Keshavaprasad, D'souza & Bhat, 2003. In: Rao *et al.* (eds.), *Frontiers of Fungal Diversity in India*. 503–511. (Fig.163a-c; 163d)

Fungus Hyphomycete. *Leaf spots* amphigenous, gray with dark brown to black margin, circular to semi-circular, 8-10 mm wide, the spots later collapses leaving the shot holes. *Colonies* on leaf spots effuse, gray. Mycelium immersed. *Setae* many, solitary, unbranched, smooth, erect, straight to slightly curved at the base, dark brown, pointed at the tip, 100-235 x 3-6 μm . Conidiomata sporodochial; *sporodochia* develop on small stromatic base, scattered, hyaline, setose, with smooth, septate, sparsely branched, hyaline to pale-coloured, 30-65 x 4-6 μm conidiophores. *Conidiogenous cells* monophialidic, integrated to discrete, 15-22 x 4-6 μm , without a conspicuous collarette. *Conidia* solitary, cylindrical, rounded at both ends, smooth, aseptate, hyaline, 17-28 x 4.5-7.5 μm .

Specimen examined: On living leaves of *Plumeria* sp. (Apocynaceae), Diwar, Tiswadi Goa, 22/09/03, Pratibha, J., Herb. No. GUBH P93.

So far described all 13 species of *Vermiculariopsiella* Blender are either litter inhabiting or endophytic. This is the first record of the fungus as foliicolous.

164. *Verticillium* sp. (Fig.164a-c; 164d)

Fungus Hyphomycete. *Leaf spots* amphigenous, off white, irregular,

sometimes 3-5 mm wide, only few spots were observed on some leaves of the tree. *Colonies* on leaf spots effuse, off white, hairy. *Mycelium* partly immersed, partly superficial, composed of sub-hyaline, smooth, branched, septate, 2-3 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to flexuous, verrucose, unbranched, septate, pale olivaceous at the base, sub-hyaline towards the apex, bearing a group of phialides at the nodal region in verticals, 580-685 x 3-4.5 μm . *Conidiogenous cells* monophialidic, discrete, arranged verticillately at the upper part of conidiophore, ampulliform, sub-hyaline, verrucose, 13-25 x 2-2.5 μm . *Conidia* aggregated in slimy heads at the tip of phialide, simple, semi-endogenous, smooth, aseptate, hyaline, 3-4.5 x 2-2.5 μm .

Specimen examined: On living leaves of *Flacourtia* sp. (Flacourtiaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P210; Culture No. GUFCC No. 4943.

The fungus was cultured by single spore isolation method. *Colonies* on MEA moderately fast growing, attaining a diam. of 2.1 cm in 7 days, circular, wet, flat, off-white, margin smooth, reverse colourless.

The genus *Verticillium* Nees ex Link, typified by *V. tenerum*, was earlier recorded as litter inhabitant. In the present study it recorded as foliicolous.

165. *Zygosporium masonii* S. Hughes, 1951. *Mycol. Pap.* 44: 15 (Fig.165a-c; 165d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown to almost black, 10-14 mm wide, one or two spots were observed on few leaves of the tree. *Colonies* on leaf spots effuse, dark brown to black. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, septate, branched, hyaline, 2-3.5 μm wide hyphae; *Conidiophores* macronematous, mononematous, solitary, unbranched, septate smooth, dark brown, erect, straight to flexuous with chains of 3-4 vesicles and

Fig. 163a-c: *Vermiculariopsiella elegans*

163a- Leaf spots

163b- Conidiomata with setae and conidia

163c- Conidia

Fig. 164a-c: *Verticillium* sp.

164a- Leaf spots

164b- Conidiomata

164c- Conidia

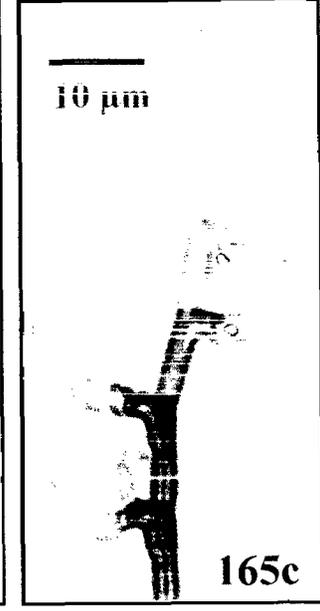
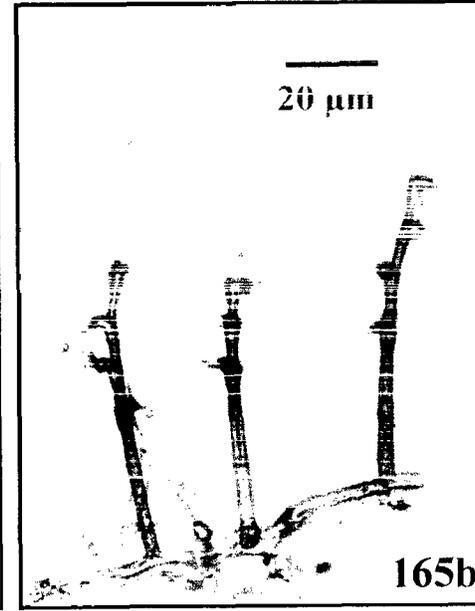
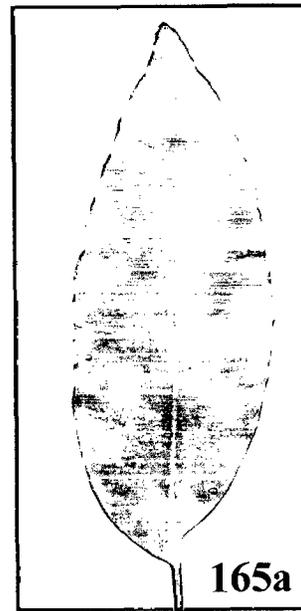
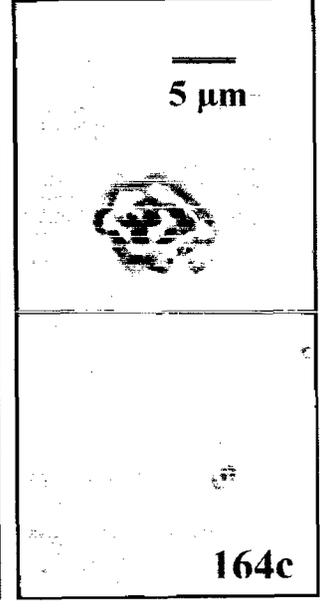
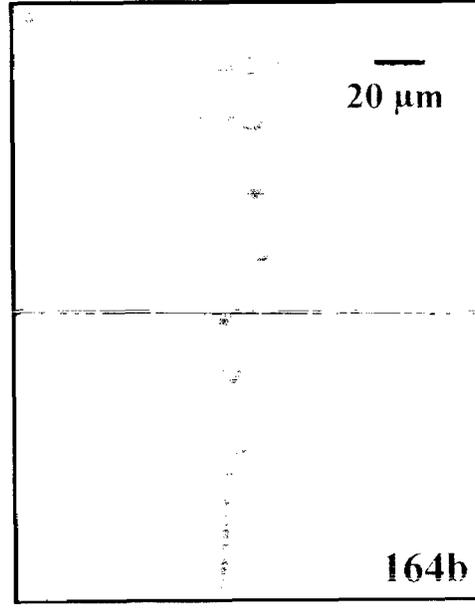
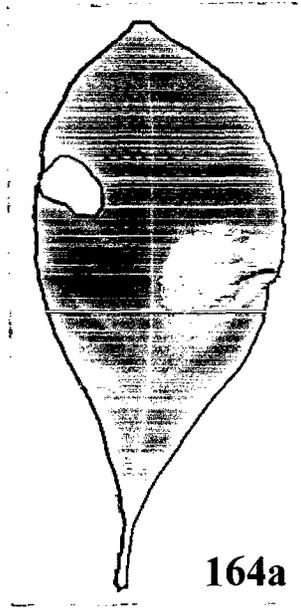
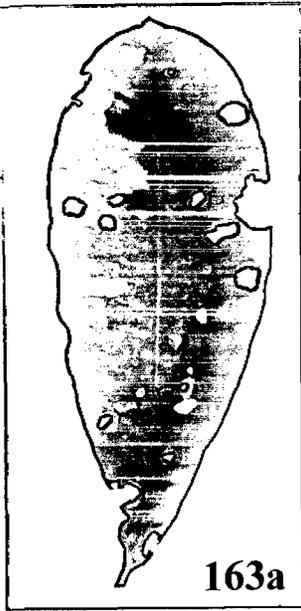
Fig. 165a-c: *Zygosporium masonii*

165a- Leaf spots

165b- Conidiomata

165c- Conidiophore with conidia

Fig. 163-165



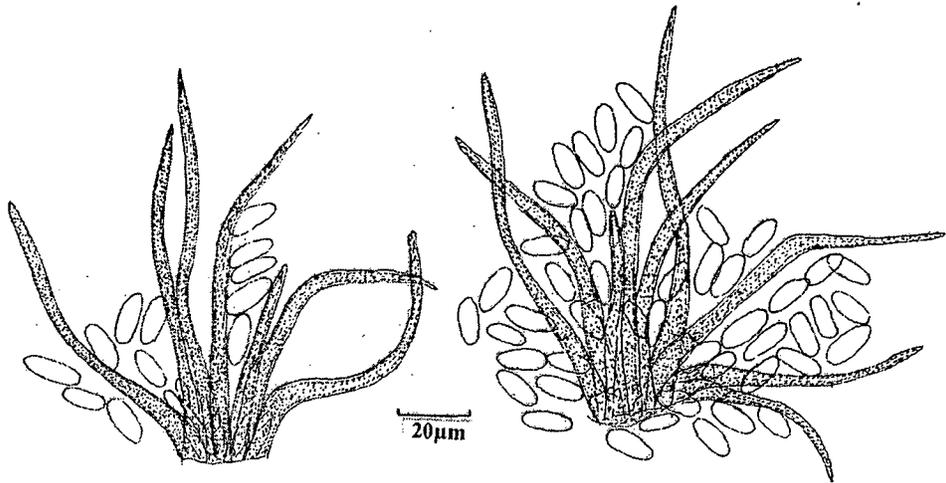


Fig. 163d *Vermiculariopsiella elegans*

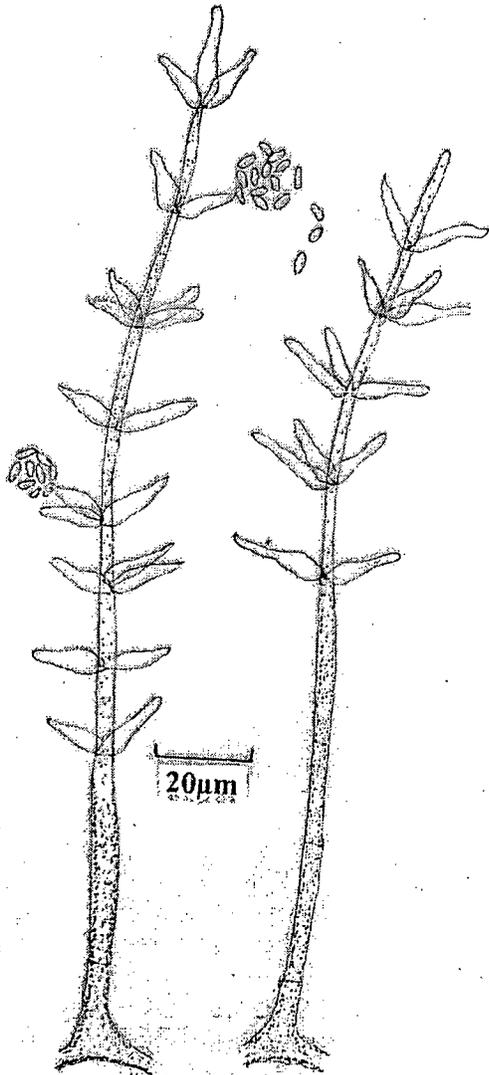


Fig. 164d *Verticillium* sp.

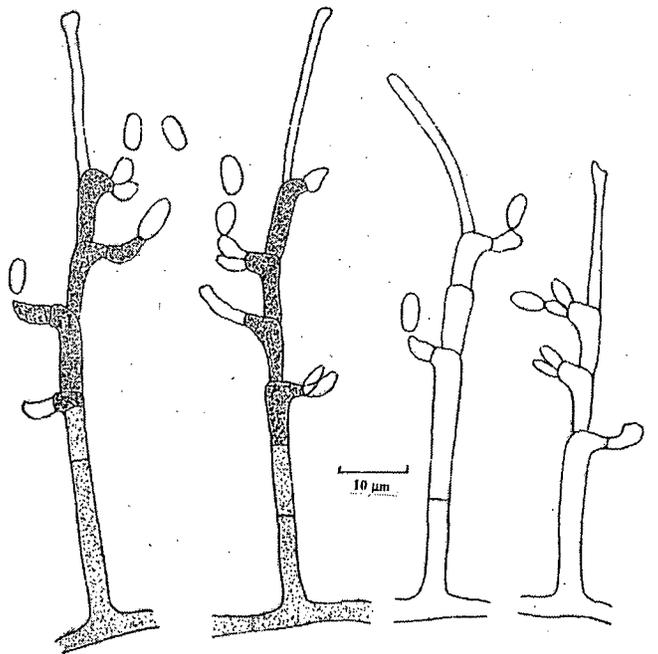


Fig. 165d *Zygosporium masonii*

a sterile hyaline apical portion which ends in a knob-like structure at the tip, 80-100 x 2-3 μm . *Conidiogenous cells* monoblastic, terminal, discrete, determinate, ampulliform, slightly curved, thin-walled, hyaline, borne in pairs at the tip of curved vesicle, 4-6 x 1.5-2 μm . Vesicle dark brown to black, smooth, thick-walled, curved 8-12.5 x 3-6 μm . *Conidia* solitary, simple, acrogenous, ellipsoidal, smooth, hyaline, aseptate, 4-6 x 2-3 μm .

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), University Campus, Taleigao, Goa, 16/06/04, Pratibha, J., Herb. No. GUBH P132.

166. *Zygosporium oscheoides* Mont., 1842. *Annl. Sci. Nat., Bot.*, sér. 2 (17): 121

(Fig.166a-c; 166d)

Fungus Hyphomycete. *Leaf spots* amphigenous, brown, irregular patches of 5-8 mm in diam were seen on the entire leaf, later spreading to form single large spot. *Colonies* on leaf spots effuse, blackish brown. *Mycelium* partly immersed, partly superficial, composed of thin, slender, smooth, hyaline, branched, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, scattered, erect, straight to flexuous, unbranched, septate, brown, smooth, bearing dark brown to black, curved, swollen, single vesicle just above the base, upper part of conidiophore setiform, sterile, 30-55.5 x 3-4 μm . vesicle 15-25 x 6.5-10.5 μm . *Conidiogenous cells* monoblastic, terminal, discrete, determinate, hyaline, borne in pairs at the top of dark brown vesicle, 4.5-9.5 x 3-5 μm . *Conidia* solitary, acrogenous, simple, sub-spherical, hyaline, smooth, aseptate, , 6.5-10 μm in diam.

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Asagao, Bardez Goa, 14/05/03, Pratibha, J., Herb. No. GUBH P30.

The genus *Zygosporium* Mont. is typified by *Z. oscheoides*. So far 23 species are known. All are true litter inhabiting fungi (Ellis, 1971; 1976). Above two described species of *Zygosporium* is recorded as foliicolous.

167. Undetermined taxon 1

(Fig.167a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, grayish brown, irregular patch covering one fourth of the leaf surface. *Colonies* on leaf spots effuse, gray, hairy. *Mycelium* immersed. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, smooth, thick walled, light brown towards the base, hyaline towards the apex, septate, unbranched, 80-140 x 7-12 μm . *Conidiogenous cells* monoblastic, terminal, integrated, hyaline, cylindrical. *Conidia* catenate, simple, smooth, thick-walled, 0-3 septate, hyaline, acrogenous, cylindrical, 25-50 x 7-11 μm . hilum thickened and darkened.

Specimen examined: On living leaves of *Alstonia scholaris* (Linn.) R.Br. (Apocynaceae), GU campus, Tiswadi Goa, 27/07/04, Dr. M.K. Janarthanam, Herb. No. GUBH P161.

168. Undetermined taxon 2

(Fig.168a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, light brown, irregular. *Colonies* on leaf spots effuse, dark brown, velvety. *Mycelium* partly immersed, partly superficial, composed of pale olivaceous, smooth, branched, septate, 2-2.5 μm wide hyphae; *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, light brown, 300-400 x 2.5-3.5 μm . *Conidiogenous cells* polyblastic, terminal, discrete, sympodial, smooth, light olivaceous, arranged in two

Fig. 166a-c: *Zygosporium oscheoides*

166a- Leaf spots

166b- Conidiomata

166c- Conidiophore with conidium

Fig. 167a-c: Undetermined taxon 1

167a- Leaf spots

167b- Conidiomata

167c- Conidia

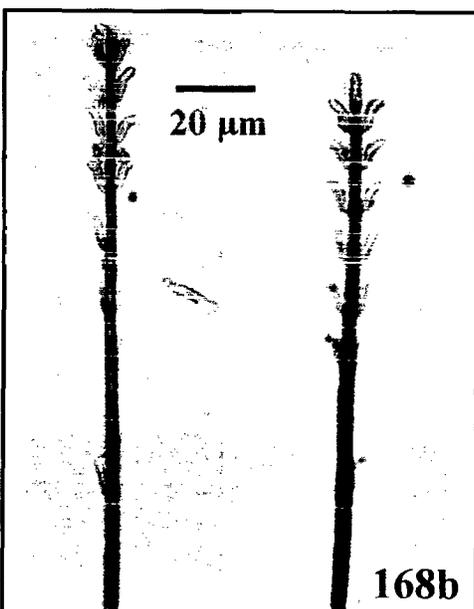
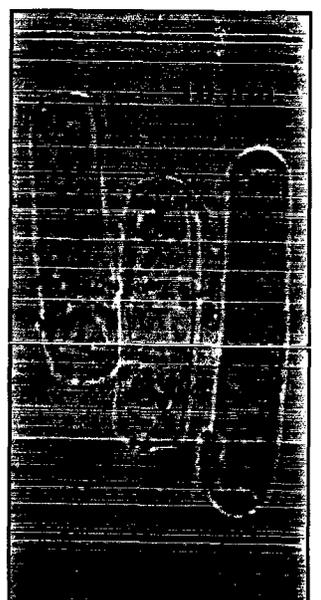
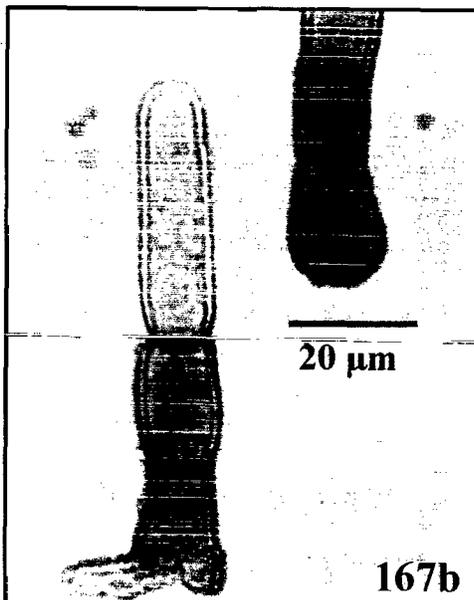
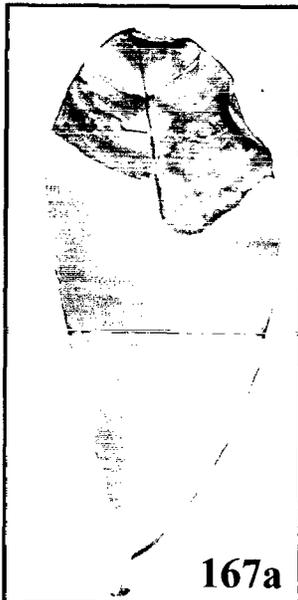
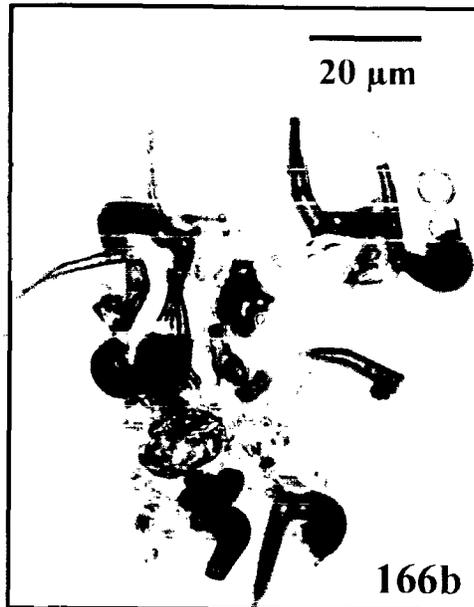
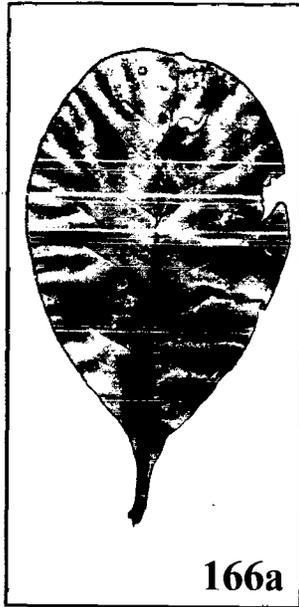
Fig. 168a-c: Undetermined taxon 2

168a- Leaf spots

168b- Conidiomata

168c- Conidiophore with conidium

Fig. 166-168



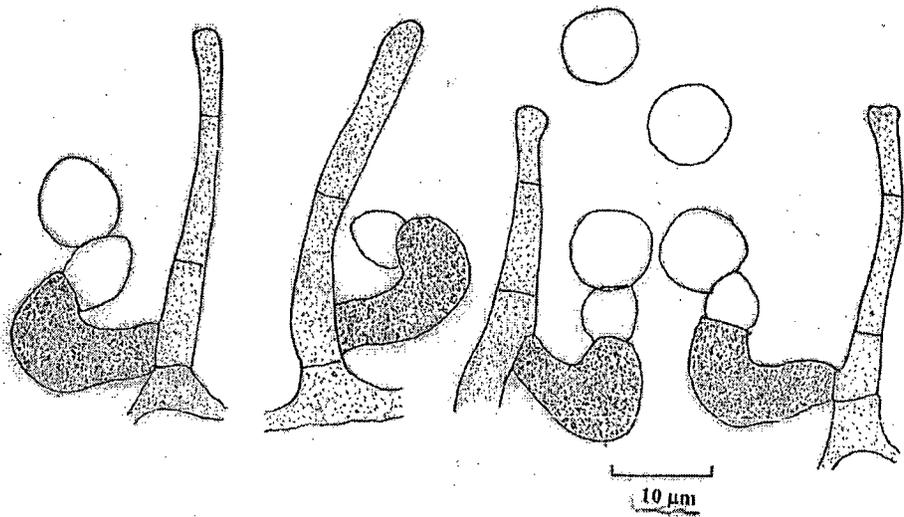


Fig. 166d *Zygosporium oscheoides*

rows on conidiophore, 8-11 x 2-3 μm , with numerous scars. *Conidia* solitary, simple, dry, acropleurogenous, sub-hyaline, smooth, aseptate, 3-4.5 x 1.5-2.5 μm .

Specimen examined: On living leaves of *Semicarpus* sp. (Anacardiaceae), Yana, Uttara Kannada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P215.

169. Undetermined taxon 3

(Fig.169a-c; 169d)

Fungus Hyphomycete. *Leaf spots* amphigenous, gray, circular, 3-6 mm in diameter, only on or two spots was observed on each leaf. Colonies on leaf spots effuse, brown. *Mycelium* internal. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to flexuous, unbranched, septate, brown at the base, sub-hyaline towards the apex, 100-150 x 3-6 μm . *Conidiogenous cells* monophialidic, terminal, determinate, integrated, sub-hyaline, 13-52 x 3-5 μm . *Conidia* solitary, simple, 1-septate, acrogenous, rounded at apex pointed towards the base, hyaline, 9.5-12.5 x 3-5 μm .

Specimen examined: On living leaves of *Plumeria* sp. (Apocynaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P79.

170. Undetermined taxon 4

(Fig.170a-c; 170d)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, grayish brown, 10-12 mm wide, only one spot was observed on few leaves. *Colonies* on leaf spots effuse, brown. *Mycelium* immersed. *Stroma* dark brown, sub-spherical. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, unbranched, septate, smooth, dark brown at the base, paler towards the apex, thick-walled, 60-117.5 x 4-6 μm . *Conidiogenous cells* monophialidic, terminal, integrated, determinate, light olivaceous, 20-40 x 3-5 μm . *Conidia* solitary, simple, aseptate, acrogenous, rounded at the tip, pointed at the base, hyaline, smooth, 12.5-17.5 x 3.5- μm .

Specimen examined: On living leaves of *Artocarpus incisa* Linn. (Moraceae) Calem, Sanguem, Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P138.

Fig. 169a-c: Undetermined taxon 3

169a- Leaf spots

169b- Conidiomata

169c- Conidiophore with conidium

Fig. 170a-c: Undetermined taxon 4

170a- Leaf spots

170b- Conidiomata

170c- Conidiophore with conidia

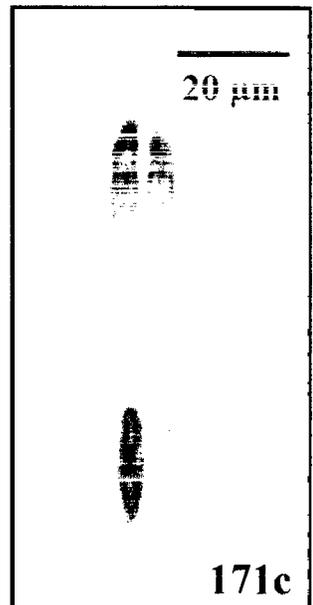
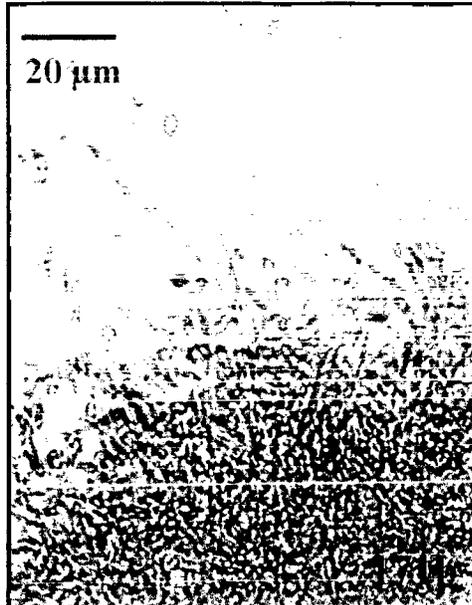
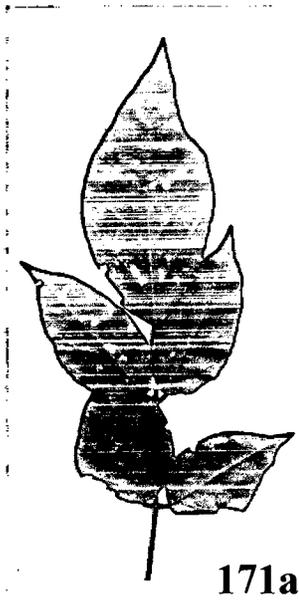
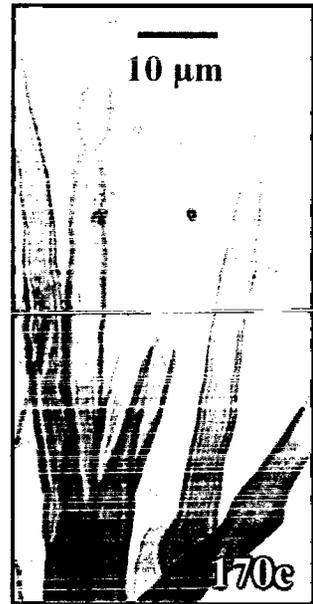
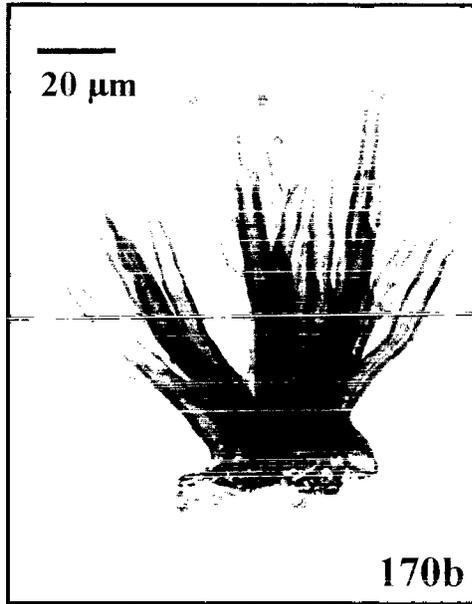
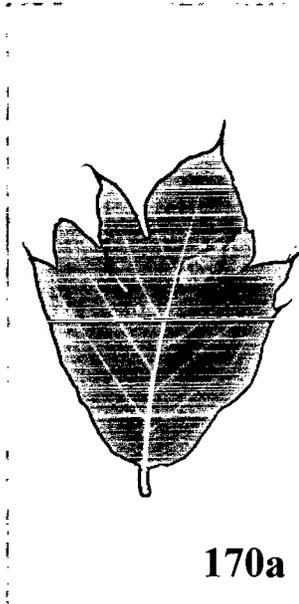
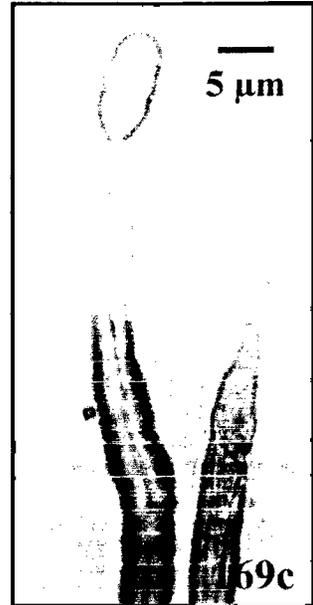
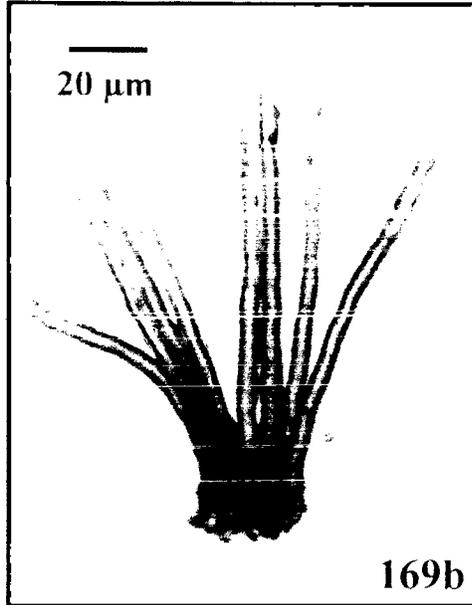
Fig. 171a-c: Undetermined taxon 5

171a- Leaf spots

171b- Conidiomata

171c- Conidia

Fig. 169-171



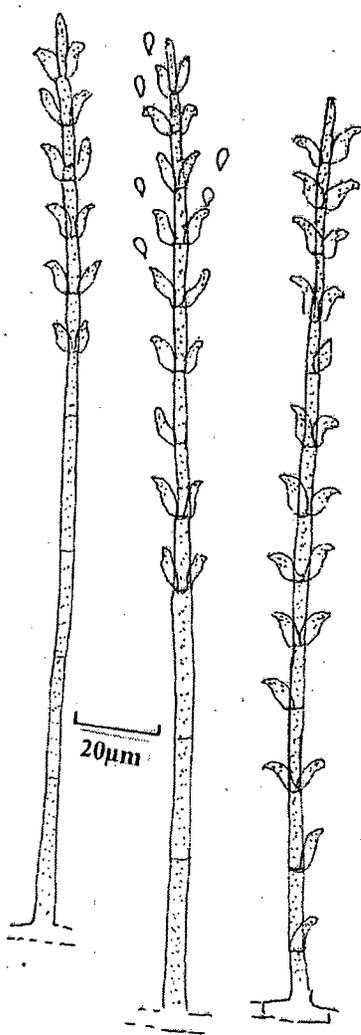


Fig. 169d Undetermined taxon 3

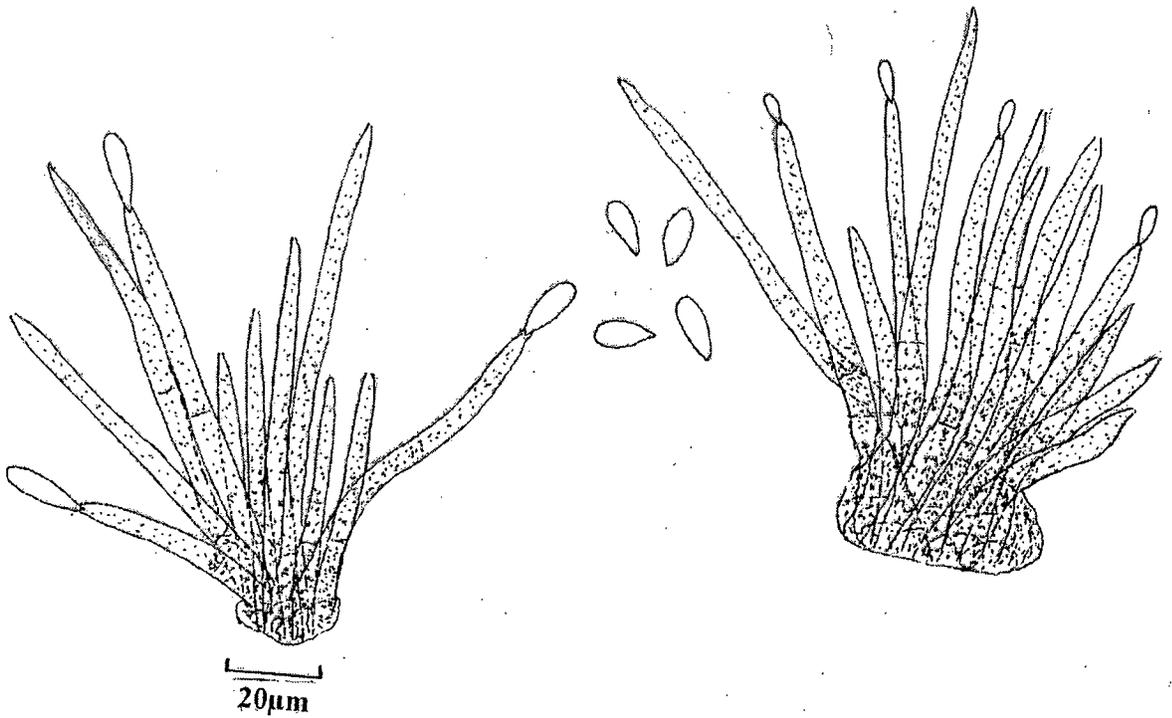


Fig. 170d Undetermined taxon 4

171. Undetermined taxon 5**(Fig.171a-c)**

Fungus Hyphomycete. *Leaf spots* amphigenous, circular, light brown, 3-6 mm in diam. *Colonies* on leaf spots effuse, white, cottony. *Mycelium* superficial, composed of thin, slender, smooth, hyaline, branched, 2-2.5 μm wide hyphae. *Stroma* poorly developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, branched, septate, smooth, hyaline, thin-walled, 30-70 x 2-3 μm . *Conidiogenous cells* monoblastic, terminal, integrated, determinate, hyaline. *Conidia* solitary, simple, aseptate, acrogenous, hyaline, smooth, 4-13 x 2.5-4 μm .

Specimen examined: On living leaves of *Pongamia pinnata* Linn. (Fabaceae) Asagao, Bardez Goa, 14/05/03, Pratibha, J., Herb. No. GUBH P31.

172. Undetermined taxon 6**(Fig.172a-c)**

Fungus Hyphomycete. *Leaf spots* amphigenous, circular to irregular, grey to light brown, 4-7 mm wide. *Colonies* on leaf spots effuse, dark brown to black, hairy. *Mycelium* partly immersed, partly superficial, composed of thin, smooth, light olivaceous, branched, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, solitary or in groups of 3-4/ erect, straight to flexuous, unbranched, septate, smooth, thick-walled, dark brown, 70-100 x 4-5 μm . *Conidiogenous cells* monotretic, terminal, integrated, determinate, light brown, 15-27 x 3-4 μm . *Conidia* solitary, simple, dry, acrogenous, sub-cylindric, sub-hyaline, pseudoseptate, smooth, 20-40-13 x 4-7 μm .

Specimen examined: On living leaves of *Ixora* sp. (Rubiaceae) Calem, Sanguem Goa, 22/06/04, Pratibha, J., Herb. No. GUBH P140.

173. Undetermined taxon 7**(Fig.173a-c)**

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, light brown. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Stroma* poorly

Fig. 172a-c: Undetermined taxon 6

172a- Leaf spots

172b- Conidiomata

172c- Conidia

Fig. 173a-c: Undetermined taxon 7

173a- Leaf spots

173b- Conidiomata

173c- Conidia

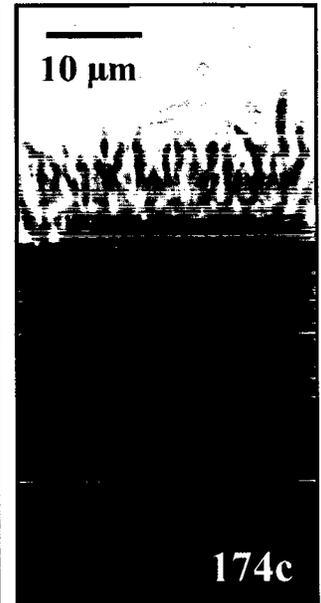
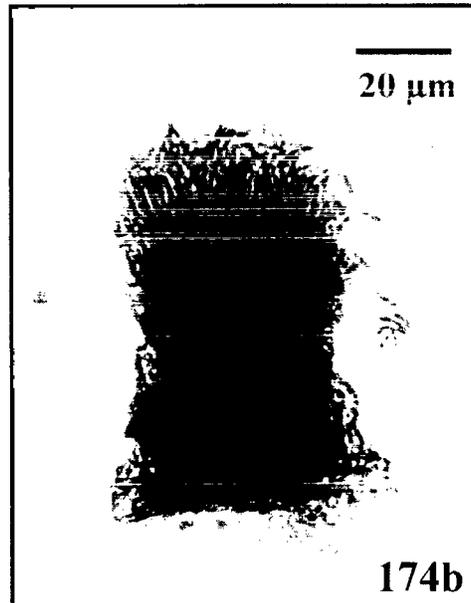
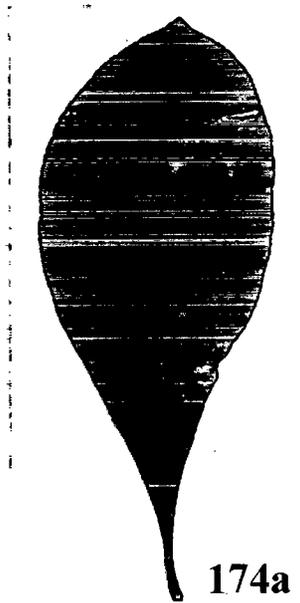
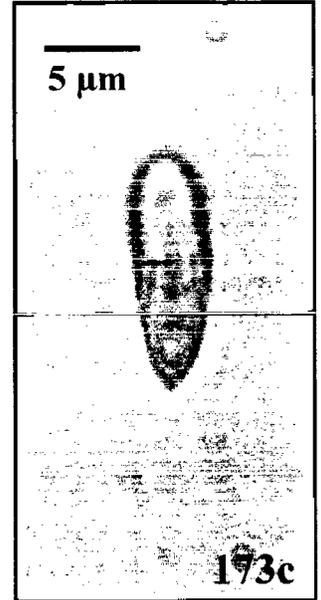
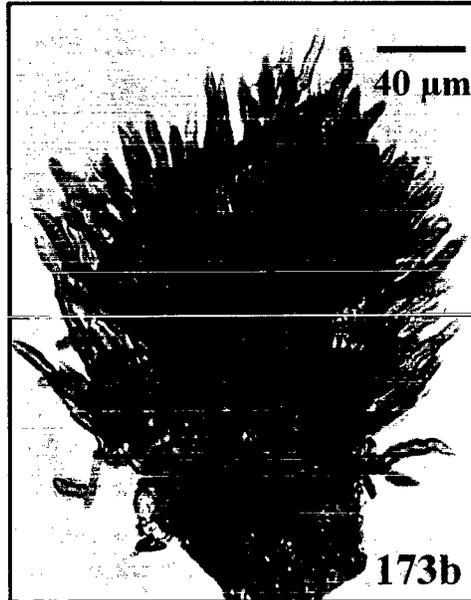
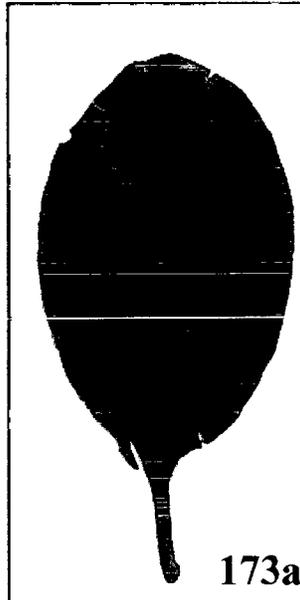
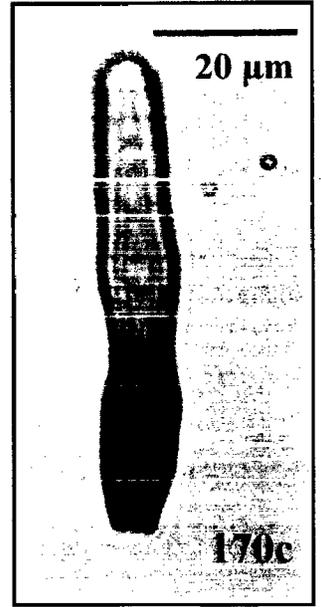
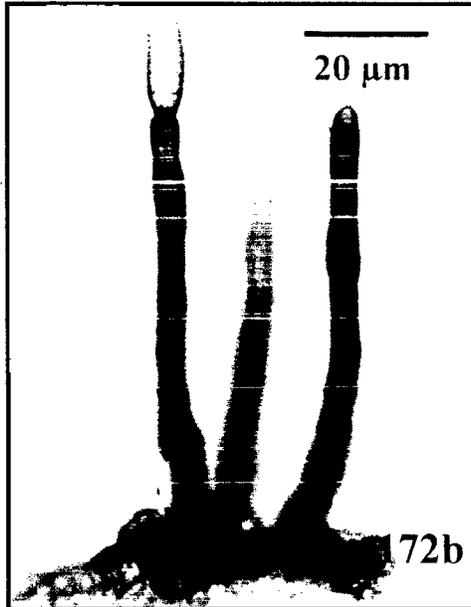
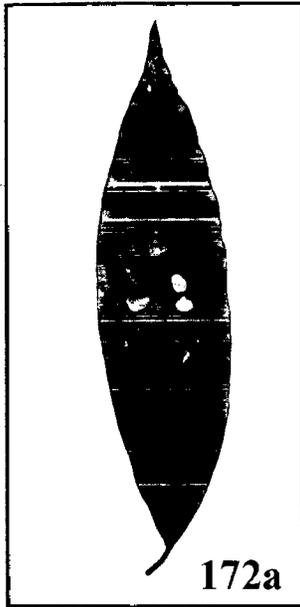
Fig. 174a-c: Undetermined taxon 8

174a- Leaf spots

174b- Conidiomata

174c- Conidiophore with conidia

Fig.172-174



developed. *Setae* and *hyphopodia* absent. *Conidiophores* macronematous, mononematous, fasciculate, erect, straight to slightly flexuous, unbranched, septate, smooth, thick walled, dark brown, 60-100 x 2-3 μm . *Conidiogenous cells* monoblastic, terminal, determinate, integrated, denticulate, light brown, smooth, with unthickened, not darkened conidial scars. *Conidia* solitary, simple, acrogenous, sub-hyaline, 0-3-septate, smooth, straight, rounded at the apex, pointed at the base with unthickened, not darkened hilum, 10-20 x 2-3.5 μm .

Specimen examined: On living leaves of *Randia domentorum* Lamk. (Rubiaceae), Amboli, Maharashtra, India, 13/09/03, Pratibha, J., Herb. No. GUBH P83.

174. Undetermined taxon 8

(Fig.174a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, dark brown to black, irregular. *Colonies* on leaf spots effuse, gray. Mycelium immersed. *Stroma none*. *Setae* and *hyphopodia* absent. Conidiomata sporodochial; *sporodochia* dark brown, with unbranched, brown, 60-70 x 2-4 μm conidiophores. *Conidia* solitary, fusiform, slightly curved, pointed at both ends, smooth, aseptate, hyaline, 4-6.5 x 1.5-2 μm .

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P94.

175. Undetermined taxon 9

(Fig.175a-c)

Fungus hyphomycete. *Leaf spots* amphigenous, dark brown to black, circular, 2-4 mm in diam. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Conidiophores* macronematous, synnematous, erect, straight to slightly flexuous, compactly arranged, smooth, septate, unbranched, dark brown at the base, paler towards the tip; synnema 130-170 x 10-20 μm . *Conidiogenous cells* monoblastic, integrated, terminal, light olivaceous, smooth, 20-35 x 2-3 μm . *Conidia* catenate,

slimy, fusiform, pointed at both the ends, hyaline, smooth, aseptate, μm , developing in branched chains, with interconidial constricted septa, $4-12 \times 1.5-2 \mu\text{m}$.

Specimen examined: On living leaves of *Syzigium* sp. (Myrtaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P94

176. Undetermined taxon 10

(Fig.176a-c)

Fungus hyphomycete. *Leaf spots* amphigenous, greyish, circular, 2-4 mm in diam. *Colonies* on leaf spots effuse, brown, hairy. *Mycelium* immersed. *Conidiophores* macronematous, synnematous, erect, straight to slightly flexuous, compactly arranged, smooth, septate, unbranched, hyaline; synnema unbranched, erect, straight to slightly flexuous, hyaline, 250-300 long, 20-40 μm broad at the base, 8-12 μm at the tip. *Conidiogenous cells* monoblastic, integrated, terminal, light olivaceous, smooth. *Conidia* catenate, slimy, developing in branched chains, with interconidial constricted septa.

Specimen examined: On living *Memycelon* sp. (Apiaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P145.

177. Undetermined taxon 11

(Fig.177a-c)

Fungus Hyphomycete. *Leaf spots* amphigenous, irregular, dark brown. *Colonies* on leaf spots effuse, dark brown. *Mycelium* partly immersed, partly superficial, composed of long, slender, thin, branched, smooth, hyaline, septate, thin-walled, 2-3 μm wide hyphae. *Stroma* none. *Setae* and *hyphopodia* absent. *Sporodochia* sessile, light brown, up to 150 μm long. *Conidiophores* macronematous, mononematous, compactly arranged to form a sporodochium, straight, light olivaceous, smooth, septate, branched, *Conidiogenous cells* monoblastic, terminal, integrated. *Conidia* simple, solitary, hyaline, smooth, cylindrical, 1-septate, $3-4.5 \times 1-1.5 \mu\text{m}$.

Fig. 175a-c: Undetermined taxon 9

175a- Leaf spots

175b- Conidiomata

175c- Conidia

Fig. 176a-c: Undetermined taxon 10

176a- Leaf spots

176b- Conidiomata

176c- Conidia

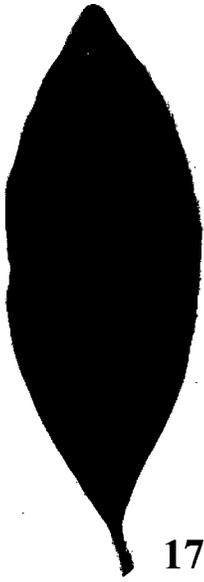
Fig. 177a-c: Undetermined taxon 11

177a- Leaf spots

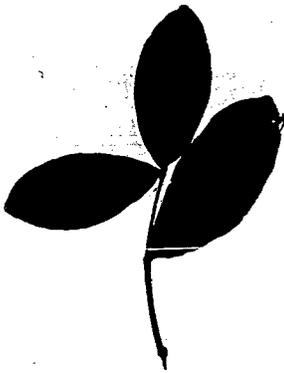
177b- Conidiomata

177c- Conidia

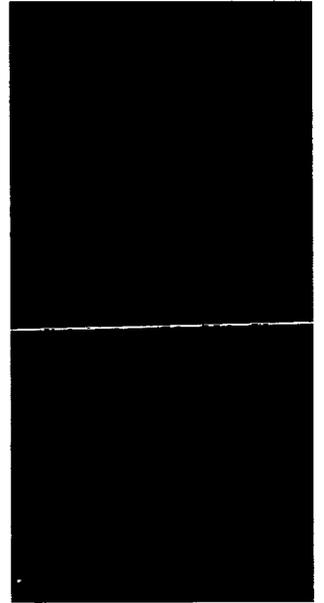
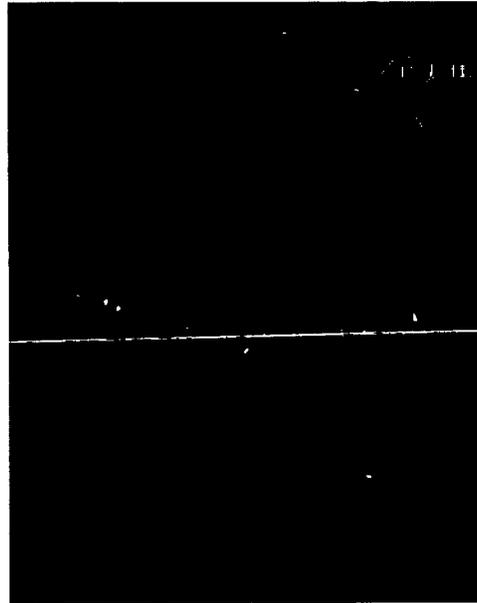
Fig. 175-177



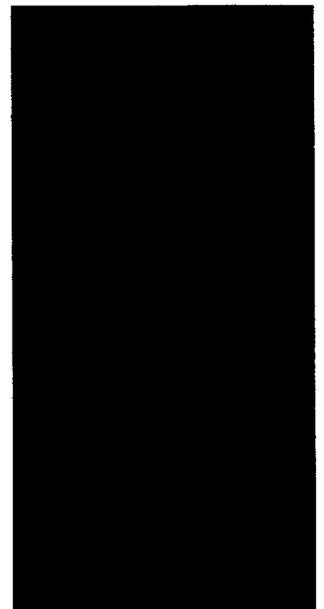
175a



176a



177a



Specimen examined: On living leaves of *Dendrocalamus* sp. (Poaceae), Yana, Uttar Kanada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P212.

The above 13 unidentified conidial fungi are treated as undetermined. These formed conidia on their conidiophores by their identity is yet to be established.

B. Coelomycetes:

1. *Chaetomella raphigera* Swift, 1930. *Mycologia* 22:165 (Fig.178a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, dark brown to black, irregular. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, superficial, light brown, sub-spherical, 70-100 μm in diam., setose; Setae erect, straight to flexuous, smooth, dark brown, 0-1-septate, 14-25 x 1.5-2.5 μm . *Conidia* solitary, simple, smooth, aseptate, hyaline, thin-walled, cylindrical, 1.5-2 x 1-1.5 μm .

Specimen examined: On living leaves of *Dendrocalamus* sp. (Poaceae), Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P191.

So far 52 species are described in the genus *Chaetomella* Fuckel, typified by *C. oblonga*. They occur as litter inhabiting fungi. Often the species were encountered in soil and freshwater streams (Nair, 2002). Some of them are also recorded from leaves.

2. *Colletotrichum capsici* (Syd.) Butl. & Bisby. 1931. *Imp. Counc. Agr. Res. India Sci. Monogr.* 1: 152 (Fig.179a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, grey, circular, sometimes irregular, later coalescing from the surface forming a shot holes, 3-6 mm in diam., spreading on entire leaf surface, mostly matured green leaflets showed the infection. *Colonies* on leaf spots effuse, dark brown. *Mycelium* partly immersed, partly superficial, composed of smooth, hyaline, 2-3 μm wide hyphae. *Conidiomata*

acervular, setose. Setae erect, straight to flexuous, unbranched, septate, dark brown, smooth, thick-walled, pointed at tip, 70-140 x 4-16 μm . Conidiogenous cells monoblastic, sub-hyaline, 15-22 x 2-3 μm . Conidia solitary, simple, aseptate, fusiform, pointed at both the ends, hyaline, smooth, 20-25 x 2-3 μm .

Specimen examined: On living leaves of *Pithecellobium dulce* (Roxb.) Benth. (Fabaceae), University campus, Taleigao, Tiswadi Goa, 01/01/03, Pratibha, J., Herb. No. GUBH P5; Culture No. GUFCC No. 4944.

Fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 5.2 cm in 7 days, circular, wooly, wooly, off-white, margin smooth, reverse off-white.

So far 4 species of *Colletotrichum* Corda, are reported from the host genus *Pithecellobium*. Our isolate showed resemblance with *C. capsici*. This is the first report of the fungus outside its parent host.

3. *Phoma zizyphae* sp. nov.

(Fig.180a-c)

Fungus Coelomycete. Leaf spots amphigenous, dark brown, circular, sometimes irregular, 3-5 mm in diam., spreading on entire leaf surface. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, semi-immersed in the host tissue, brown, smooth, globose, 180-220 μm in diam. *Conidiogenous cells* monophialidic, sub-hyaline, smooth, unbranched, 8-12 x 1.5-2 μm . *Conidia* solitary, simple, 1-septate, hyaline, smooth, thin-walled, 6-9 x 1.5-2 μm .

Holotype: On living leaves of *Zizyphus mauritiana* Lamk. (Rhamnaceae), University campus, Taleigao, Tiswadi Goa, 21/01/03, Pratibha, J., Herb. No. GUBH P11.

Sutton (1980) documented 26 species of *Phoma* Sacc. These are cosmopolitan in distribution. Our isolate does not match with any of the described species and on living leaves of *Zizyphus mauritiana*, this is a new foliicolous species.

Fig. 178a-c: *Chaetomella raphigera*

178a- Leaf spots

178b- Conidiomata

178c- Conidia

Fig. 179a-c: *Colletotrichum capsici*

179a- Leaf spots

179b- Conidiomata

179c- Conidia

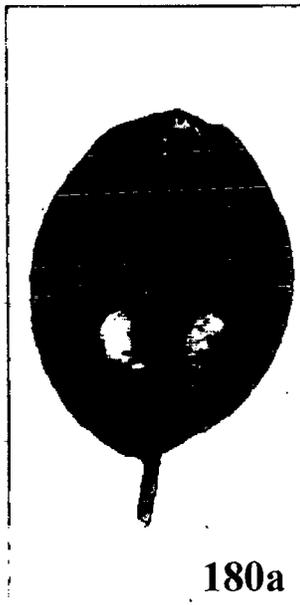
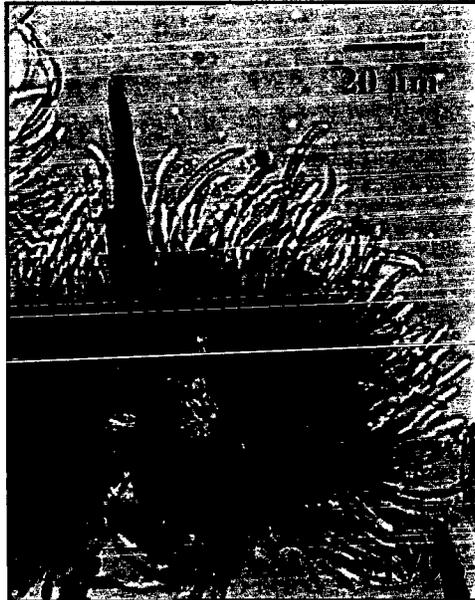
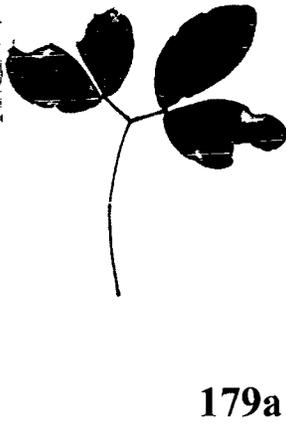
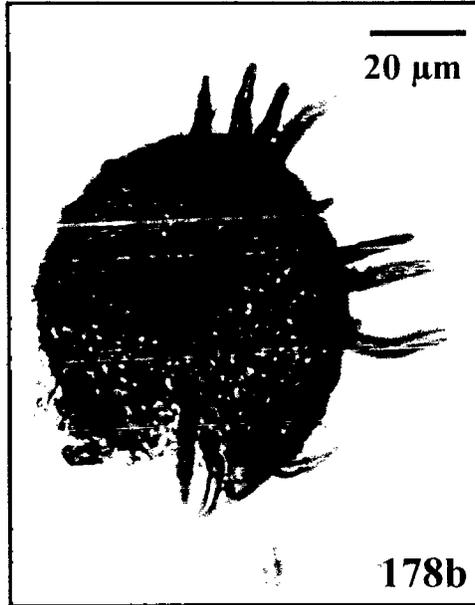
Fig. 180a-c: *Phoma zizyphae*

180a- Leaf spots

180b- Conidiomata

180c- Conidia

Fig. 178-180



4. *Pestalotiopsis guepinii* (Desm.) Stey., 1949, *Bulletin Jard. Bot. de l'Etat Bruxelles* 19(3): 312. (Fig.181a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, light brown, forming irregular patches on entire surface of leaf. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, at first immersed in the host tissue, later becoming errumpent, dark brown to almost black. *Conidia* solitary, simple, straight, 3-4-septate, 15-23 x 7-9 μm ; basal cell hyaline, thin-walled, with smooth, hyaline, thin-walled, 2-3 apical appendages; middle cells dark brown, thick-walled hyaline, smooth, thin-walled.

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), University campus, Taleigao, Tiswadi Goa, 01/03/03, Pratibha, J., Herb. No. GUBH P19.

This species generally occurs on monocot hosts. On *Careya*, this is a new record.

5. *Polychaeton bougainvilleae* Manohar., Kunwar, Sharath & Nagamani. 2003. *J. Mycol. Pl. Pathol.* 33(2): 212-216. (Fig.182a-c)

Fungus Coelomycete. *Leaf spots* hypogenous, black, irregular. *Colonies* on leaf spots effuse, black, velvety, hypophyllous, growing superficially on the surface of leaf. *Mycelium* superficial consists of septate, branched, hyaline, 2-3 μm hyphae. *Conidiomata* pycnidial. *Pycnidia* erect, straight to flexuous, 315-575 x 35-90 μm , thick-walled, consists of 110-205 x 7-4 μm wide ostiolar tube. *Conidia* simple, aseptate, hyaline, smooth, cylindrical, 3-5 x 1.5-2 μm .

Specimen examined: On living leaves of *Michelia champaka* Linn. (Magnoliaceae), Colem, Sanguem Goa, 03/09/03, Pratibha, J., Herb. No. GUBH P69.

6. *Polychaeton* sp. (Fig.183a-c)

Fungus Coelomycete. *Leaf spots* hypogenous, greenish pink, tiny, irregular.

Fig. 181a-c: *Pestalotiopsis guepinii*

181a- Leaf spots

181b- Conidiomata

181c- Conidium

Fig. 182a-c: *Polychaeton bougainvilleae*

182a- Leaf spots

182b- Conidiomata

182c- Conidiophore

Fig. 183a-c: *Polychaeton* sp.

183a- Leaf spots

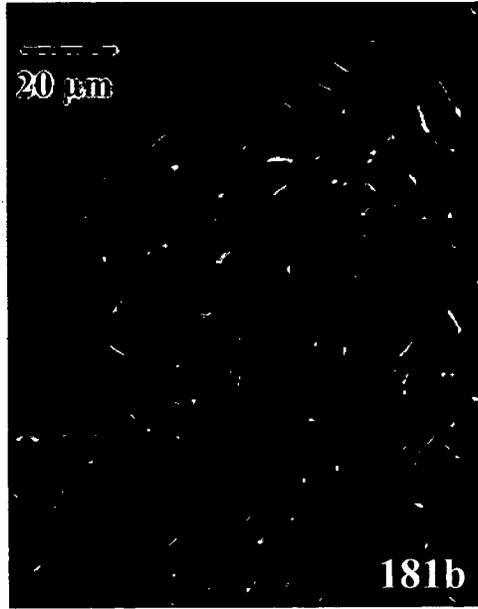
183b- Conidiomata

183c- Conidia

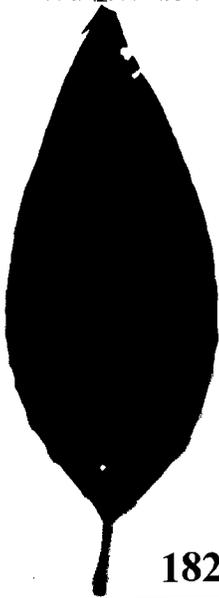
Fig. 181-183



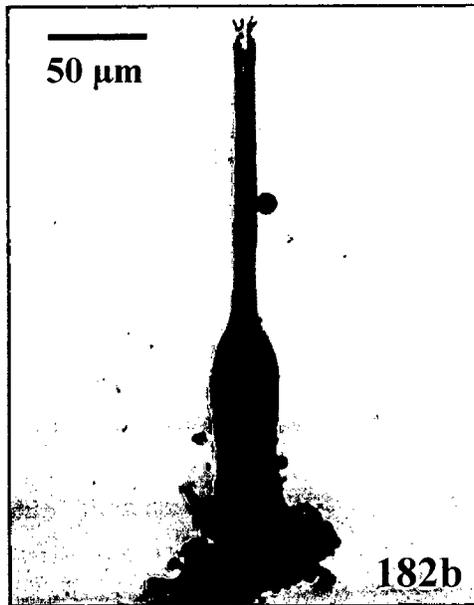
181a



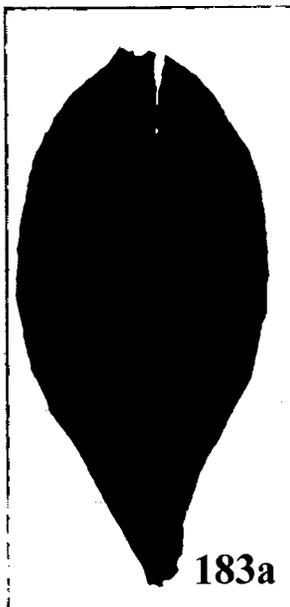
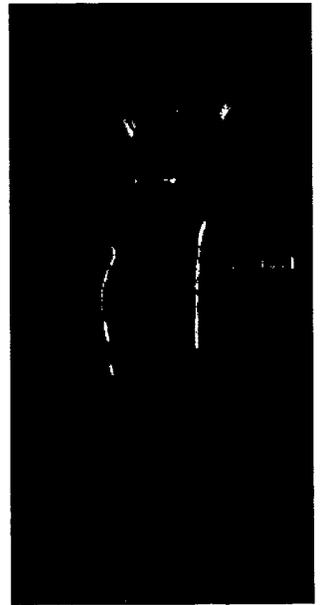
181b



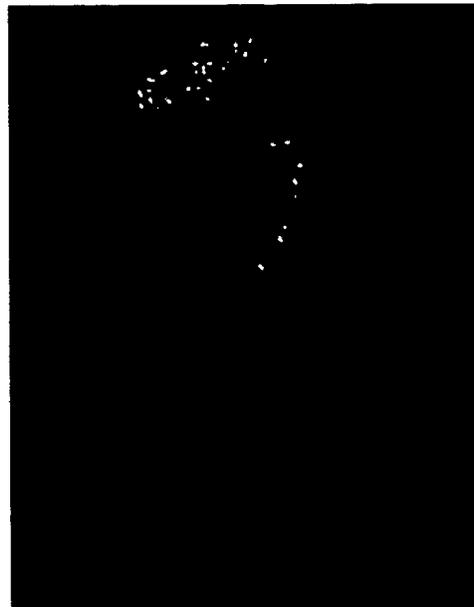
182a



182b



183a



Colonies on leaf spots effuse, green, velvety, hypophyllous, growing superficially on the surface of leaf. *Mycelium* superficial consists of septate, branched, hyaline, 2-3 μm hyphae. *Conidiomata* pycnidial. *Pycnidia* erect, straight to flexuous, 80-175 x 7-15 μm . *Conidia* simple, aseptate, hyaline, smooth, cylindrical, 3-6 x 1.5-2 μm .

Specimen examined: On living leaves of *Terminalia catappa* Linn. (Combretaceae), Campal, Tiswadi Goa, 09/11/03, Pratibha, J., Herb. No. GUBH P111.

So far 7 species are described under the genus *Polychaeton* (Pers.) Lév. Based on conidial and pycnidial dimensions, *Polychaeton* sp. 1 is very near to *P.*

bougainvilleae.

7. *Septoria* sp.

(Fig.184a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, dark brown in the centre with yellow halo, circular, 3-5 mm in diam., spreading on entire leaf surface and most of the leaves showed infection. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, immersed in the host tissue, light brown. Conidiogenous cells monoblastic, sub-hyaline. *Conidia* solitary, simple, septate, hyaline, smooth, thin-walled, slightly curved, 17-35 x 2-3 μm .

Specimen examined: On living leaves of *Ficus benghalensis* Linn. (Moraceae), Pilerna, Pernem, Goa, 18/10/03, Pratibha, J., Herb. No. GUBH P107.

8. *Uredo* sp.

(Fig.185a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, dark brown, irregular, 5-8 mm in diam. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, partly immersed in the host tissue, sub-hyaline, 270 μm . *Conidiogenous cells* monoblastic, sub-hyaline. *Conidia* solitary, simple, aseptate, hyaline, smooth, 4-5 x 1-1.5 μm .

Fig. 184a-c: *Septoria* sp.

184a- Leaf spots

184b- Conidiogenous cells with conidia

184c- Conidia

Fig. 185a-c: *Uredo* sp.

185a- Leaf spots

185b- Conidiomata

185c- Conidia

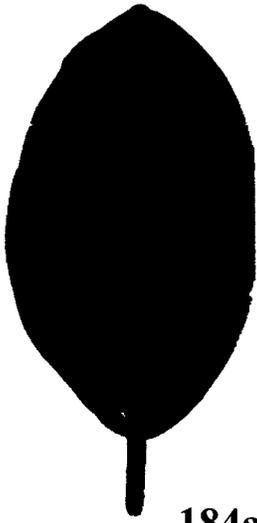
Fig. 186a-c: Undetermined taxon 12

186a- Leaf spots

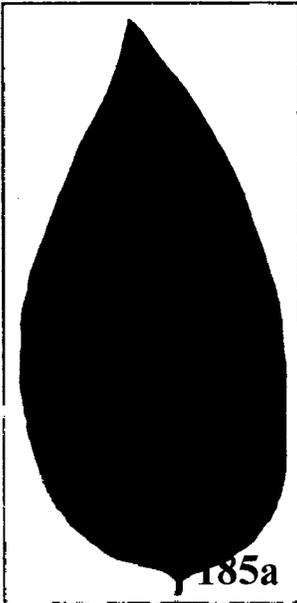
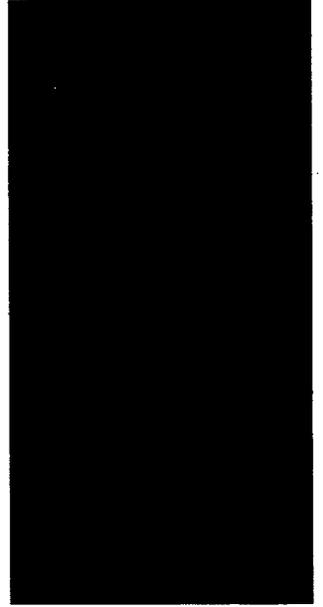
186b- Conidiomata

186c- Conidia

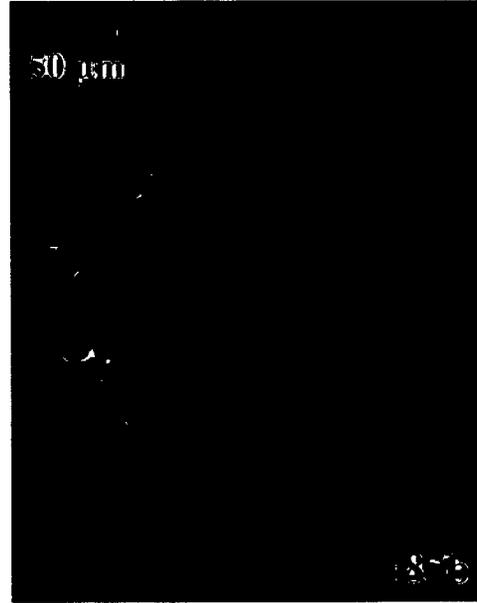
Fig. 184-186



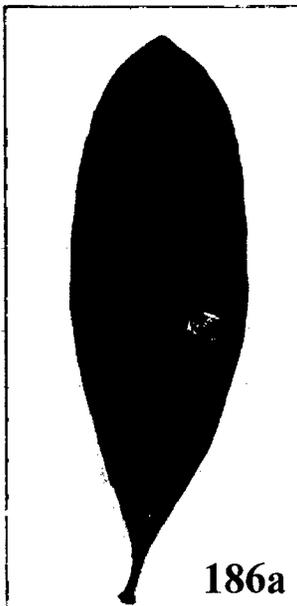
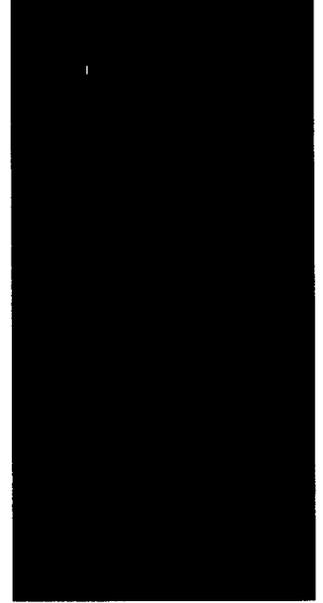
184a



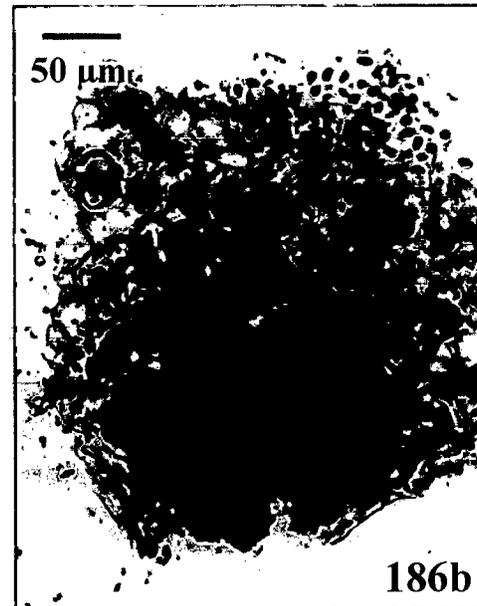
185a



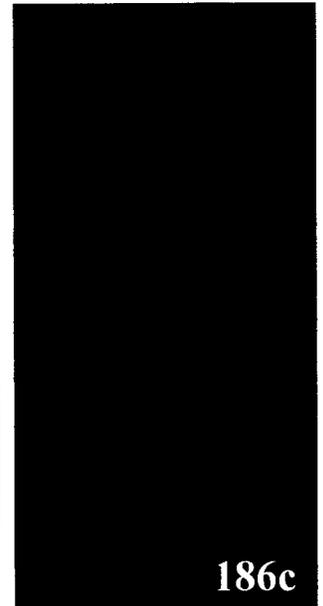
185b



186a



186b



186c

Specimen examined: On living leaves of *Phyllanthus acida* (L.) Skeels. (Euphorbiaceae), University campus, Taleigao, Tiswadi Goa, 05/11/03, Pratibha, J., Herb. No. GUBH P110, Culture No.

9. Undetermined taxon 12

(Fig.186a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, greyish, irregular, 2-12 mm wide, only one or two spots were observed on few leaves of the tree. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, partly immersed in the host tissue, dark brown to black, globose, 120-140 μm in diam. *Conidia* solitary, simple, hyaline, smooth, aseptate, cylindrical, 8-12 x 5-7 μm .

Specimen examined: On living leaves of *Garcinia indica* Choisy (Cluiaceae), University campus, Taleigao, Tiswadi Goa, 01/03/03, Pratibha, J., Herb. No. GUBH P20.

10. Undetermined taxon 13

(Fig.187a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, brown irregular, only one or two spots were observed on few leaves of the tree. *Colonies* on leaf spots dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, partly immersed in the host tissue, brown. *Conidia* solitary, simple, hyaline, smooth, 2-septate, constricted at the septa, middle cell darker than the other cells. 14-22 x 6-9 μm .

Specimen examined: On living leaves of *Bridelia* sp. (Euphorbiaceae), Amboli, Sawantwadi, Maharashtra, 13/09/03, Pratibha, J., Herb. No. GUBH P88.

11. Undetermined taxon 14

(Fig.188a-c)

Fungus Coelomycete. *Leaf spots* amphigenous, dark brown, irregular, 5-8 mm in diam. *Colonies* on leaf spots effuse, dark brown. *Mycelium* immersed. *Conidiomata* pycnidial, partly immersed in the host tissue, light brown, setose; *Setae* erect, straight to slightly flexuous, dark brown, thick-walled, unbranched, septate, pointed at the tip,

Fig. 187a-c: Undetermined taxon 13

187a- Leaf spots

187b- Conidiomata

187c- Conidia

Fig. 188a-c: Undetermined taxon 14

188a- Leaf spots

188b- Conidiomata

188c- Conidia

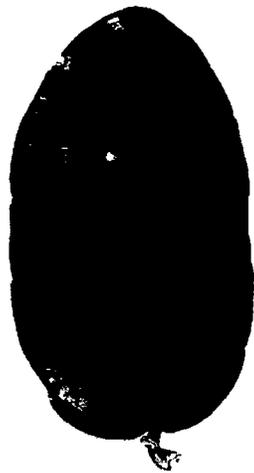
Fig. 189a-c: Undetermined taxon 15

189a- Leaf spots

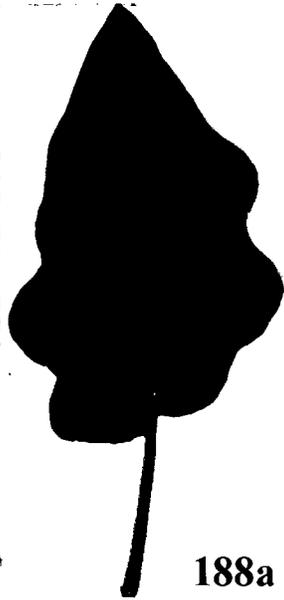
189b- Conidiomata

189c- Pycnidium

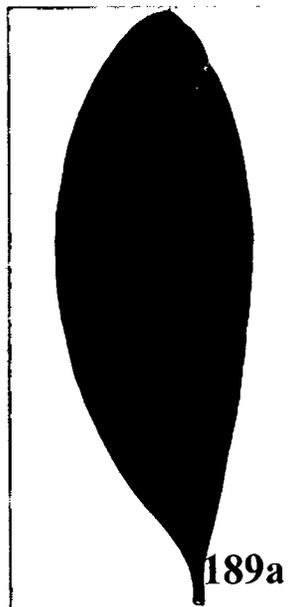
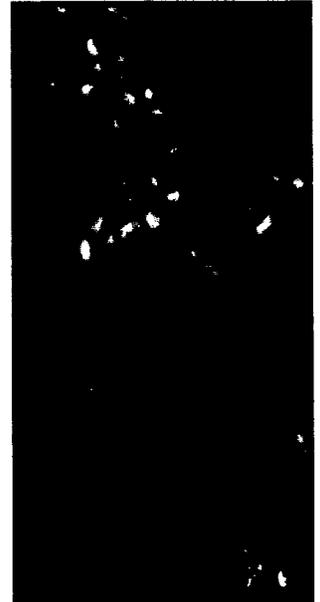
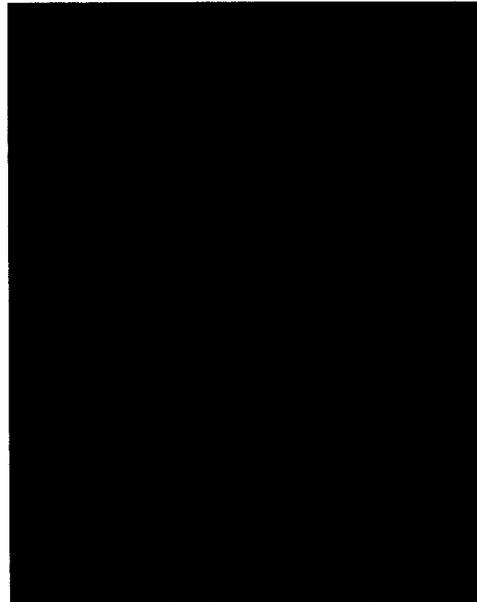
Fig. 187-189



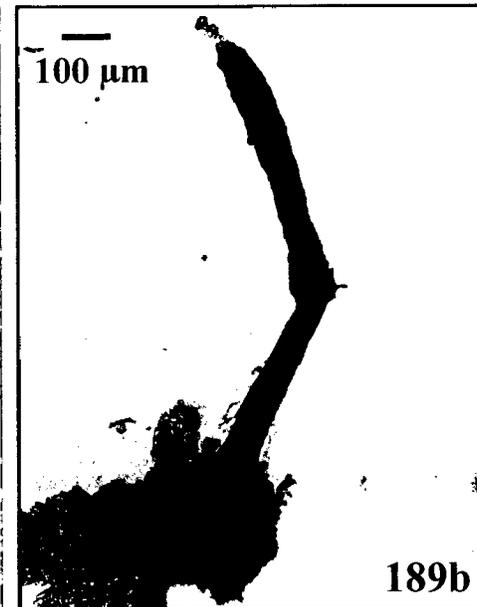
187a



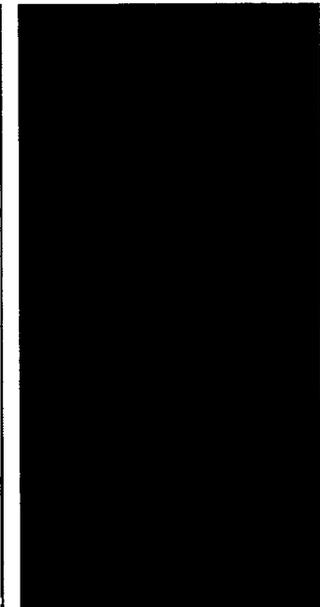
188a



189a



189b



165-275 μm . *Conidiogenous cells* monoblastic, sub-hyaline. *Conidia* solitary, simple, aseptate, hyaline, smooth, 4-5 x 1-1.5 μm .

Specimen examined: On living leaves of *Solanum melongena* Linn. (Solanaceae), Banastari, Ponda, Goa, 28/10/03, Pratibha, J., Herb. No. GUBH P109.

12. Undetermined taxon 15

(Fig.189a-c)

Fungus Coelomycete. *Leaf spots* hypogenous, black, irregular. *Colonies* on leaf spots effuse, black, velvety, hypophyllous, growing superficially on the surface of leaf. *Mycelium* superficially forming a network of flakes of radiating, inconspicuous, septate, brown hyphae, without hyphopodia. *Conidiomata* pycnidial. Pycnidia erect, straight to flexuous, 435-810 x 24-35 μm , thick-walled, consists of slightly swollen ventre upto 40-60 μm wide. *Conidiogenous cells* monoblastic, sub-hyaline. *Conidia* simple, aseptate, hyaline, smooth, cylindrical, aggregating in a slimy mass, 18-30 x 15-20 μm .

Specimen examined: On living leaves of *Psychotria dalzellii* Hook. (Rubiaceae), Cotigao, Cancona Goa, 16/08/03, Pratibha, J., Herb. No. GUBH P62.

In all, 4 unidentified pycnidial fungi were recorded on different leaf spots. These were studied for their identity. Majority of them were without any conidiogenous cells. In some, conidia were not present. Therefore, all these were recorded as undetermined taxa.

C. Ascomycetes:

1. *Asterina lawsoniae* Henn. & E. Nyman. 1900. In: Warburg, *Monsunia. Beiträge zur Kenntnis der Vegetation des süd- und ostasiatischen Monsungebietes* (Leipzig) 1:

159

(Fig.190a-c)

Fungus Ascomycete. Leaf spots epigenous, black spots. Colonies on leaf spots effuse, brown to black, velvety. Mycelium superficial, composed of brown, wavy, hyphopodiate, 3-5 μm wide hyphae. Thyrothecia sometimes fused together, upto 150-200 μm in diam., opening by a stellate fissure at maturity. Asci sub-spherical, 8-spored, 20-30 μm in diam. Ascospores irregularly arranged, in the ascus, light brown, 1-septate, constricted at the septum, 12-18 x 6-9 μm .

Pycnidia spherical, 30-60 μm in diam. *Conidia* aseptate, dark brown, smooth, thick-walled, cylindrical, rounded at both the ends, with a median transverse hyaline band, 12-20 x 6-9 μm .

Specimen examined: On living leaves of *Lawsonia inermis* (L.) WALL. (Apocynaceae), Banastari, Ponda Goa, 19/02/03, Pratibha, J., Herb. No. GUBH P103.

So far only one species of *Asterina* Lev. is reported on the host genus *Lawsonia*. On comparison of morpho-taxonomic features, our isolate matched with the same.

2. *Botryosphaeria* sp.

(Fig.191a-c)

Fungus Ascomycete. Leaf spots amphigenous, dark brown, circular, sometimes irregular, 3-5 mm in diam. *Ascocarp* partly superficial, partly submerged in the host tissue, solitary, sessile, dark brown to black, globose, 95-110 μm in diam. Stroma none. *Asci* unitunicate, 8-spored, sub-hyaline, stalked, apically rounded, without apical apparatus, inoperculate, straight to slightly curved, clavate, 50-100 x 4-6 μm . *Ascospores* ellipsoidal, smooth, aseptate, dark brown to black, 10-13 x 4.5 μm , arranged in one row.

Specimen examined: On living leaves of *Careya arborea* Roxb. (Myrtaceae), Tambdi Surla, Sanguem Goa, 27/09/03, Pratibha, J., Herb. No. GUBH P97.

Fig. 190a-c: *Asterina lawsoniae*
190a- Leaf spots
190b- Ascomata
190c- Asci with ascospores

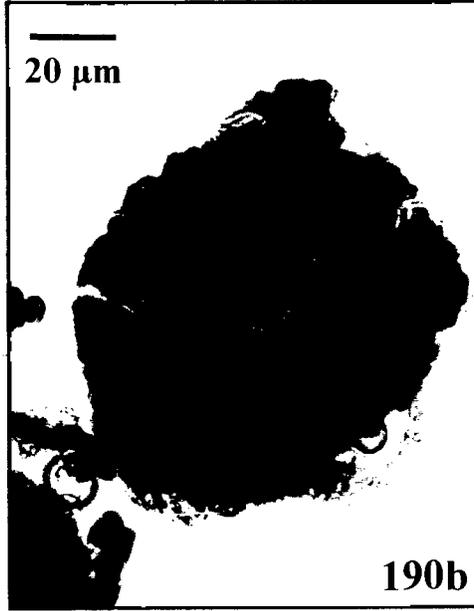
Fig. 191a-c: *Botryosphaeria* sp.
191a- Leaf spots
191b- Ascomata
191c- Asci with ascospores

Fig. 192a-c: *Meliola holarrhenae*
192a- Leaf spots
192b- Ascomata with setae
192c- Ascospores

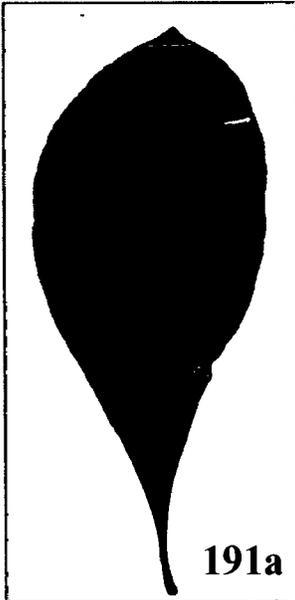
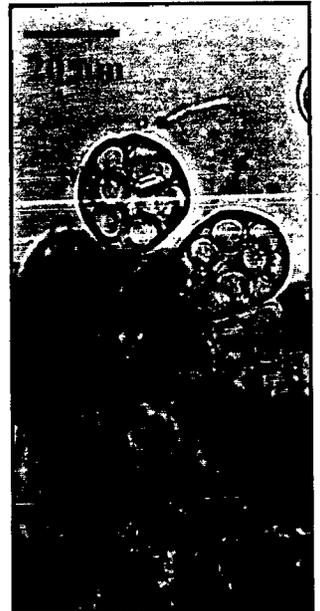
Fig. 190-192



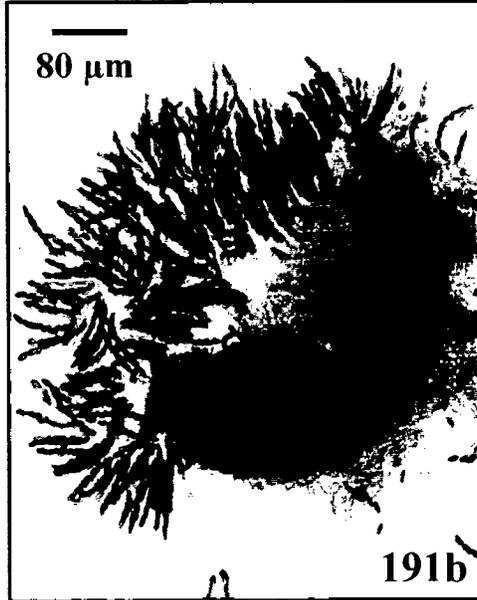
190a



190b



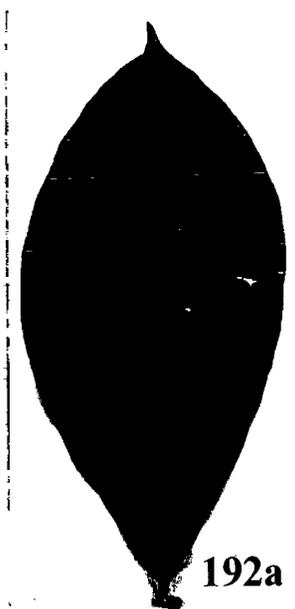
191a



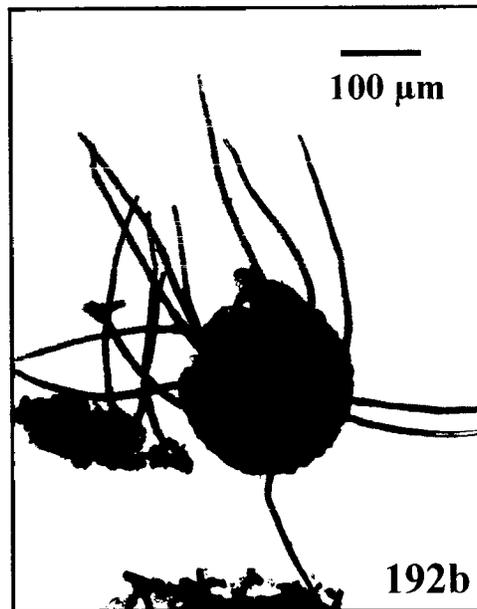
191b



191c



192a



192b



192c

3. *Meliola holarrhenae* Hansf. & Thirum., 1948. *Farlowia* 3: 294 (Fig.192a-c)

Fungus Ascomycete. Leaf spots epigenous, black spots. *Colonies* on leaf spots effuse, hypophyllous, dense, dark brown to black, velvety. *Hyphae* straight to flexuous, branched, smooth, thick-walled, dark brown, 4-7 μm wide. *Hyphopodia* alternate, 14-17 x 6-9 μm , dark brown. *Setae* erect, straight to flexuous, smooth, unbranched, thick-walled, dark brown to black, septate, 160-320 x 6-9 μm . *Ascocarp* perithecial, superficial, sessile, dark brown to black, globose, verrucose, setiform, upto 250 μm in diam. *Ascospores* ellipsoidal, dark brown, 4-septate, constricted at the septa, 35-40 x 10-14 μm .

Specimen examined: On living leaves of *Holarrhena pubescens* (L.) WALL. (Apocynaceae), Banastari, Ponda Goa, 19/02/03, Pratibha, J., Herb. No. GUBH P18.

Two species of *Meliola* Fr. viz. *M. holarrhenae* and *M. simillima* Ellis & Everh are reported on the host genus *Holarrhena*.

4. *Meliola* sp. (Fig.193a-c)

Fungus Ascomycete. Leaf spots epigenous, black spots. *Colonies* on leaf spots effuse, hypophyllous, dense, dark brown to black, velvety. *Hyphae* straight to flexuous, branched, smooth, thick-walled, dark brown, 7-8 μm wide. *Hyphopodia* alternate, sessile, dark brown 18-27 x 8-12 μm . *Setae* erect, straight to flexuous, smooth, unbranched, thick-walled, dark brown to black, septate, 600-800 x 6-8 μm . *Ascocarp* perithecial, superficial, sessile, dark brown to black, globose, setiform, upto 300 μm in diam. *Ascospores* ellipsoidal, dark brown to black, 4-septate, constricted at the septa, 50-60 x 20-25 μm .

Specimen examined: On living leaves of *Memycelon* sp. (Melastomataceae), Banastari, Ponda Goa, 07/06/04, Pratibha, J., Herb. No. GUBH P127.

5. *Parodiella hedysari* (Schwein.) S. Hughes, 1958. *Can. J. Bot.*: 75 (Fig.194a-c)

Fungus Ascomycete. No distinct spots, fungus appears as tiny black spot on the surface of leaf. *Ascocarp* perithecial; perithecium solitary, superficial, appearing like tiny spots on the surface of leaf, globose, dark brown to black, 170-260 μm in diam. *Asci* bitunicate, 8-spored, sub-hyaline, pedicillate, cylindrical to clavate, rounded at the apex, without apical apparatus, inoperculate, straight to slightly curved, 90-115 x 15-22 μm . Paraphysis absent. *Ascospores* biseriate, elliptic to biconvex, smooth, brown, 1-septate, distinctly striated, constricted at the septum, 20-32 x 7-12 μm .

Specimen examined: On living leaves of *Desmodium trifolium*, University Campus, Taleigao Goa, 09/07/04, Pratibha, J., Herb. No. GUBH P149, Culture No. GUFCC No. 4945.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 7.5 cm in 7 days, circular, wooly, off-white, margin smooth, reverse off-white.

Four species of *Parodiella* Speg., viz. *P. grammodes-reticulata* Ellis & Everh., *P. paraguayensis* Speg., *P. hedsari* and *P. perisporioides* (Berk. & Curtis) Speg., are so far reported on the host genus *Desmodium*. Our isolate showed similarity with *P. hedsari*.

6. *Phyllachora ixorae* Theiss. & Syd., 1915. *Annls mycol.* 13(3-4): 553 (Fig.195a-c)

Fungus Ascomycete. No distinct leaf spots, fungus appears as tar spot on the surface of leaf. *Ascocarp* cleistothecial, solitary, sessile, partly submerged in the host tissue, dark brown to black. *Asci* unitunicate, 8-spored, sub-hyaline, pedicillate, clavate, rounded at the apex, without apical apparatus, inoperculate, straight 100-160 x 8-10 μm . Paraphysis absent *Ascospores* uniseriate, ellipsoidal, cylindrical, smooth, hyaline, guttulate, 12-20 x 5-7.5 μm .

Fig. 193a-c: *Meliola* sp.

193a- Leaf spots

193b- Ascomata

193c- Ascospores

Fig. 194a-c: *Parodiella hedysar*

194a- Leaf spots

194b- T.S. of Ascomata

194c- Ascus with ascospores

Fig. 195a-c: *Phyllachora ixorae*

195a- Leaf spots

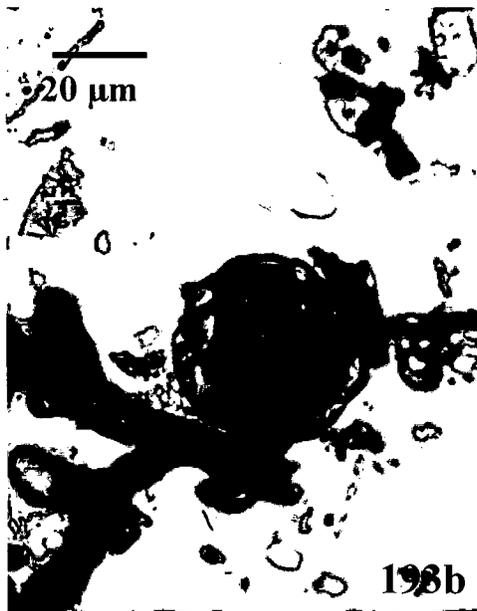
195b- Asci

195c- Ascus with ascospores

Fig. 193-195



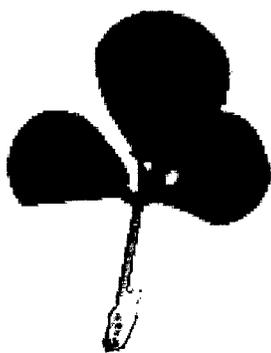
193a



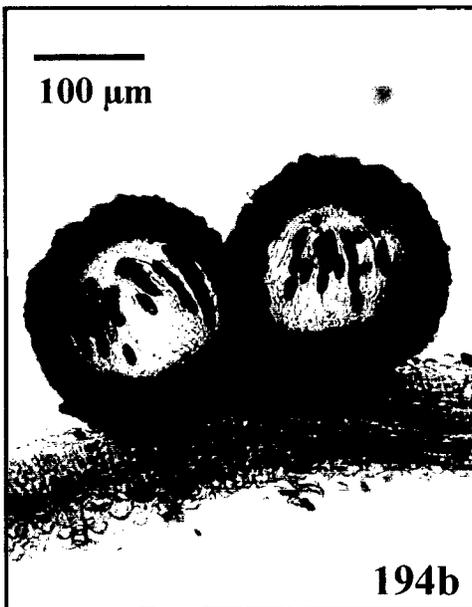
193b



193c



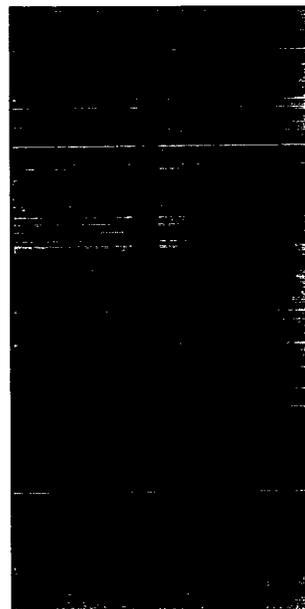
194a



194b



195a



Specimen examined: On living leaves *Ixora* sp. (Rubiaceae) Yana, Uttara Kanada, Karnataka, India, 21/01/05, Pratibha, J., Herb. No. GUBH P205.

Only one species, of *Phyllachora* Nitschke ex Fuckel i.e. *P. ixorae* is reported so far on *Ixora*.

7. *Phyllachora* sp.

(Fig.196a-c)

Fungus Ascomycete. No distinct leaf spots, fungus appears as tar spot on the surface of leaf. *Ascocarp* cleistothecial, solitary, sessile, partly submerged in the host tissue, dark brown. *Asci* unitunicate, 8-spored, sub-hyaline, pedicellate, cylindrical, rounded at the apex, without apical apparatus, inoperculate, straight to slightly curved, 55-70 x 7-9 μm . Paraphysis absent. *Ascospores* uniseriate, fusiform to ellipsoidal, cylindrical, smooth, hyaline, gutulate, 12-15 x 4-6 μm .

Specimen examined: On living leaves *Abrus precatorius* Linn. (Fabaceae) Colem, Sanguem Goa, 16/01/05, Pratibha, J., Herb. No. GUBH P186.

8. Undetermined taxon 16

(Fig.197a-c)

Fungus Ascomycete. Leaf spots amphigenous, dark brown, irregular. *Ascocarp* perithecial, superficial, sessile, obpyriform, 100-120 x 80-100 μm , solitary, dark brown, ostiolate, Stroma none; *Peridium* membranous, pseudoparenchymatous. *Paraphyses* absent. *Asci* unitunicate, 8-spored, sub-hyaline, pedicelled, apically rounded, without apical apparatus, inoperculate, 30-40 x 5-7 μm . *Ascospores* 1-2 seriate, ellipsoidal, smooth, 1-septate, 8-12 x 2-3 μm .

Specimen examined: On living leaves of *Mangifera indica* Linn. (Anacardiaceae), Valpoi, Sattari Goa, 05/07/03, Pratibha, J., Herb. No. GUBH P39.

9. Undetermined taxon 17

(Fig.198a-c)

Fungus Ascomycete. Leaf spots amphigenous, dark brown, circular, sometimes irregular, 3-5 mm in diam. *Ascocarp* cleistothecial, partly submerged in the host tissue, appearing as a tiny spot on the surface of leaf, solitary, dark brown,

Fig. 196a-c: *Phyllachora* sp.

196a- Leaf spots

196b- Ascomata

196c- Ascus with ascospores

Fig. 197a-c: Undetermined taxon 16

197a- Leaf spots

197b- Ascomata

197c- Asci

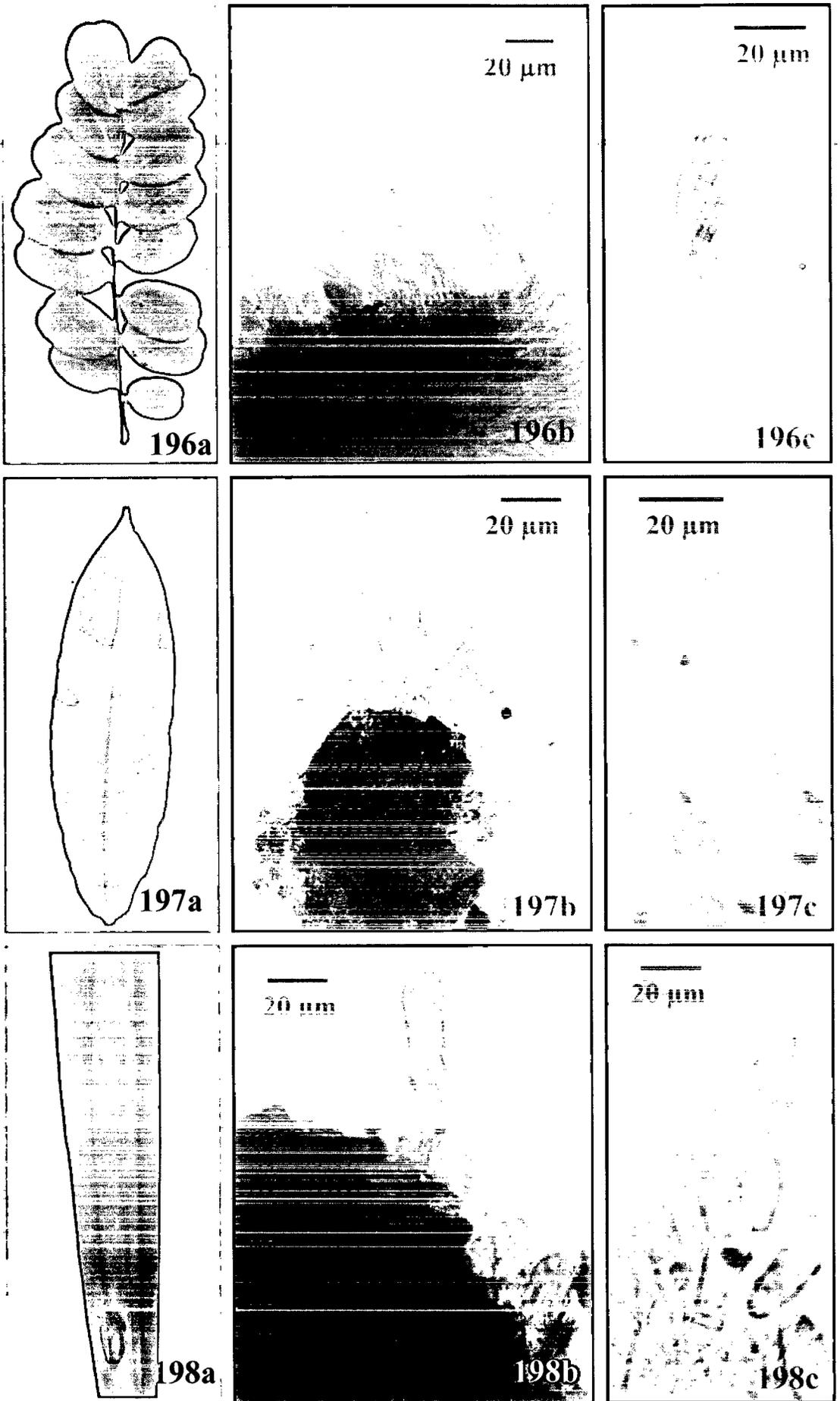
Fig. 198a-c: Undetermined taxon 17

198a- Leaf spots

198b- Ascomata with ascus

198c- Ascus with ascospores

Fig. 196-198



globose, 160-180 μm in diam. Stroma none; Peridium pseudoparenchymatous, 6-7 layered, outermost layer black, inner layers dark brown. Paraphyses absent. Asci bitunicate, 8-spored, sub-hyaline to olivaceous brown, stalked, apically rounded with sub-apical apparatus, inoperculate, straight, sometimes slightly curved, 60-80 \times 14-17 μm . Ascospores obovoid, smooth, aseptate, hyaline, 14-17 \times 5-7 μm , arranged in two rows.

Specimen examined: On living leaves of *Areca catechu* Linn. (Arecaceae), Kesarwal, Goa, 12/07/03, Pratibha, J., Herb. No. GUBH P50.

10. Undetermined taxon 18

(Fig.199a-c)

Fungus Ascomycete. Leaf spots amphigenous, dark brown, irregular, 4-5 mm wide. *Ascocarp* perithecial, superficial, solitary, sessile, light brown, pear shaped, ostiolate, 80-110 \times 50-80 μm . Stroma none. *Peridium* pseudoparenchymatous, brown, 4-5 layered. Paraphysis absent. *Asci* unitunicate, 8-spored, sub-hyaline, stalked, apically rounded, without apical apparatus, inoperculate, straight, clavate, 40-48 \times 6-8 μm . *Ascospores* clavate, smooth, 3-septate, hyaline, 14-16 \times 3-4 μm , arranged in 2-3 rows.

Specimen examined: On living leaves of *Calamus* sp. (Arecaceae), Bondla, Ponda Goa, 02/08/03, Pratibha, J., Herb. No. GUBH P59.

11. Undetermined taxon 19

(Fig.200a-c)

Fungus Ascomycete. Leaf spots amphigenous, dark brown, irregular. *Ascocarp* perithecial, superficial, solitary, sessile, off-white to yellowish, ovoid, ostiolate, 60-85 \times 65-70 μm . Stroma none. *Peridium* pseudoparenchymatous, brown, 4-6 layered. *Paraphysis* absent. *Asci* unitunicate, 8-spored, hyaline, stalked, apically rounded, without apical apparatus, inoperculate, straight, clavate, 45-55 \times 5-7.5 μm .

Fig. 199a-c: Undetermined taxon 18

199a- Leaf spots

199b- Ascomata

199c- Ascus with ascospores

Fig. 200a-c: Undetermined taxon 19

200a- Leaf spots

200b- Ascomata

200c- Ascus with ascospores

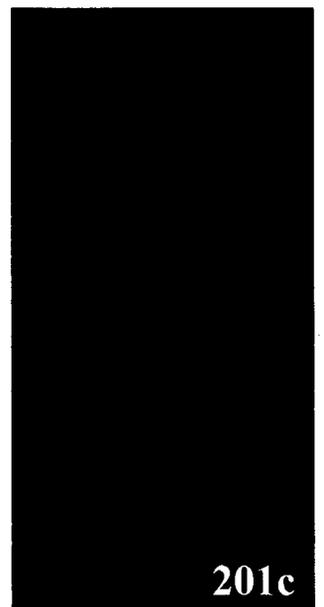
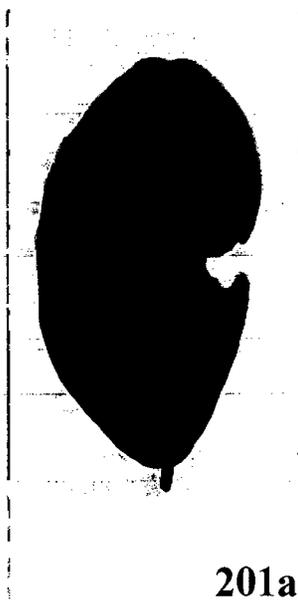
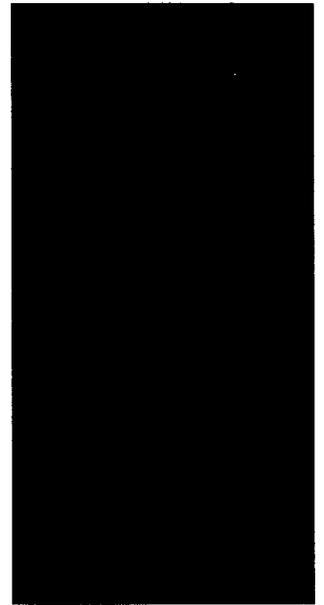
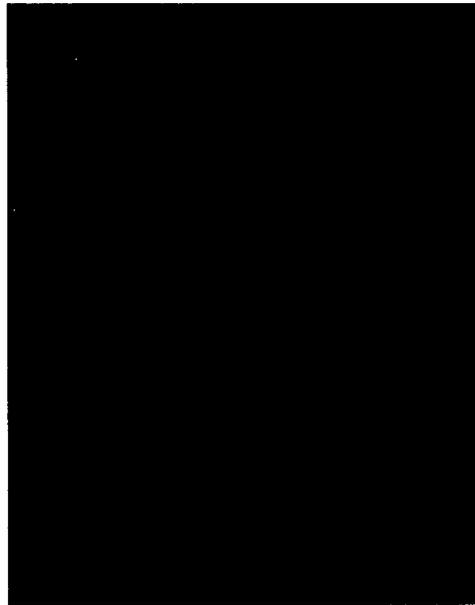
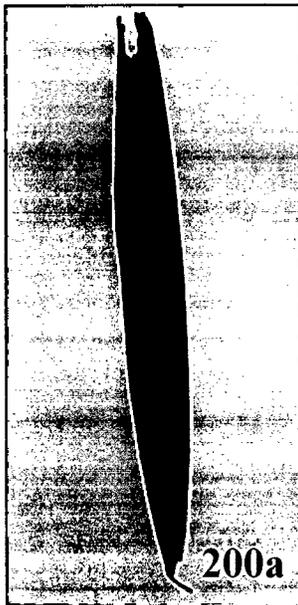
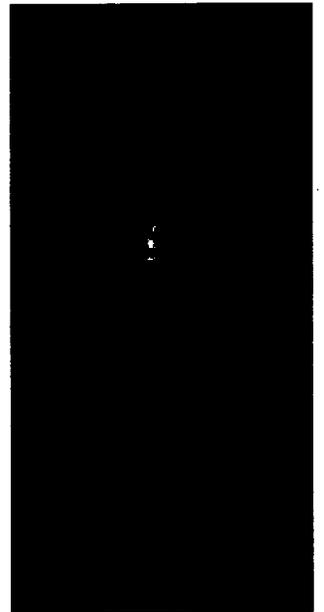
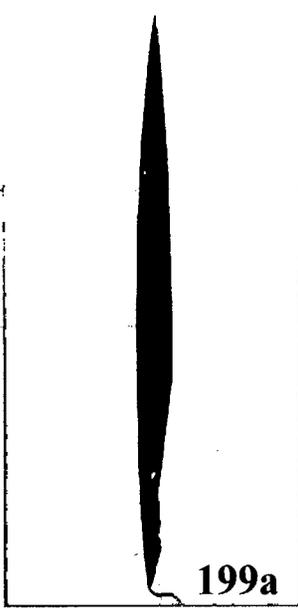
Fig. 201a-c: Undetermined taxon 20

201a- Leaf spots

201b- Ascomata

201c- Asci

Fig. 199-201



Ascospores fusiform, smooth, 4-septate, hyaline, 18-22 x 2.5-3 μm , arranged in 2-3 rows.

Specimen examined: On living leaves of *Calamus* sp. (Arecaceae), Bondla, Ponda Goa, 02/08/03, Pratibha, J., Herb. No. GUBH P59.

12. Undetermined taxon 20

(Fig.201a-c)

Fungus Ascomycete. Leaf spots amphigenous, dark brown, irregular. *Ascocarp* partly superficial, partly submerged in the host tissue, solitary, sessile, dark brown. Stroma none. Paraphysis hyaline, 2-3.5 μm wide. *Asci* unitunicate, 8-spored, sub-hyaline, stalked, apically rounded, without apical apparatus, inoperculate, straight to slightly curved, clavate, 40-65 x 6-8 μm . *Ascospores* ellipsoidal, smooth, aseptate, hyaline, 10-14 x 3.4.5 μm , arranged in 2 rows.

Specimen examined: On living leaves of *Bridelia* sp. (Euphorbiaceae), Amboli, Sawantwadi, Maharashtra India, 13/09/03, Pratibha, J., Herb. No. GUBH P89; Culture No. GUFCC No. 4946.

The fungus was cultured by single spore isolation method. *Colonies* on MEA fast growing, attaining a diam. of 9.0 cm in 7 days, circular, cottony, off-white, margin serrated, reverse off-white.

13. Undetermined taxon 21

(Fig.202a-c)

Fungus Ascomycete. *Lesions* epigenous, irregular, grayish in the center, brown towards the margin. *Fungus* Ascomycete. *Colonies* effuse, grayish brown. *Mycelium* immersed, composed of septate, branched, hyaline to subhyaline, smooth, 2-4 μm wide hyphae. *Ascocarp* perithecial, stalked, solitary, dark brown, velvety, roughened on the surface, with an elongated wide ostiole at the tip, 207.5-300.5 x 40-67.5; stalk erect, cylindrical, dark brown, slightly wider at the basal region, narrower below the venter (*ascocarp* proper), 115-140 x 35-40 μm ; venter perched on the tip of the stalk, oval, dark brown, wider in the middle and narrow on either ends, 70-100 x

45-67.5 μm ; ostiolar canal cylindrical, moderately brown, truncate at the tip, 27.5-55 x 40-50 μm . Stroma none. *Peridium* soft, composed of outer brown, thick-walled, polygonal cells (2-3.5 μm diam) in 2-3 layers and inner 4-5 layers of thin-walled, elongated cells (2-3 x 2-4.5 μm). *Asci* unitunicate, 8-spored, obclavate, apically rounded, pedicellate, do not stain blue with iodine, 18.5 - 28.5 x 4.5 - 7 μm . *Ascospores* globose, smooth, light brown, aseptate, 2.5-4.5 μm diam., sometimes arranged in two rows. *Paraphyses* absent.

Specimen examined: On leaves of *Garcinia indica*, 2/1/2005, Ashish P., Mashem, Canacona, Goa, India, Herb. GUBH No. P166. Additional specimen examined: On leaves of *Garcinia indica*, 22/10/2005, D.J. Bhat, Ankola, Uttara Kannada, Karnataka, India, Herb. GUBH No. P166; Culture No. GUFCC No. 4947.

The fungus was cultured by single spore isolation method. *Colonies* on MEA slow growing, attaining a diam. of 0.4 cm in 7 days, irregular, flat, velvety, brown, margin irregularly serrated, reverse dark brown to black.

Fig. 202

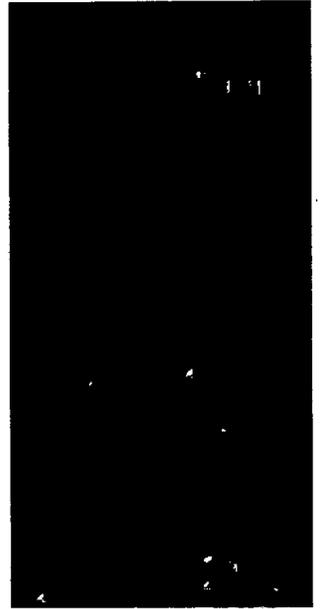


Table 1: List of foliicolous Hyphomycetes documented during the course of the study:

Sr. No.	Hyphomycetes	Plant Substrate/Host	Date of Collection	Locality	Herb. No.
1.	<i>Acremonium</i> sp.	<i>Calicopteris floribunda</i>	16-01-05	Colem	GUBH-P194
2.	<i>Acroconidiellina arecae</i>	<i>Areca catechu</i>	15-03-03	Colem	GUBH-P70
3.	<i>Acrophialophora indica</i> sp. nov.	<i>Tabernaemontana coronaria</i>	15-03-03	Banastari	GUBH-P24
4.	<i>Alternaria longissima</i>	<i>Urena lobata</i>	13-11-03	Donapaula	GUBH-P114
5.	<i>Alternaria tenuissima</i>	<i>Ficus benghalensis</i>	07-01-03	GU Campus	GUBH-P7
6.	<i>Ardhachandra selenoides</i>	<i>Careya arborea</i>	03-09-03	Molem	GUBH-P78
7.	<i>Bahusutrabeeja dwaya</i>	<i>Malotus philippinensis</i>	26-08-04	Colem	GUBH-P168
8.	<i>Bahusutrabeeja manoharacharii</i>	<i>Bridelia scandens</i>	02-07-04	Chorla	GUBH-P143
9.	<i>Beltrania rhombica</i>	<i>Bridelia</i> sp.	13-09-03	Amboli	GUBH-P91
10.	<i>Beltraniella portoricensis</i>	<i>Bridelia</i> sp.	13-09-03	Amboli	GUBH-P87
11.	<i>Ceeveesubramaniomyces litseai</i> sp. nov.	<i>Litsea</i> sp.	21-01-05	Yana	GUBH-P198
12.	<i>Ceratosporella deviata</i>	<i>Lagerstromea</i> sp.	17-07-04	Amboli	GUBH-P153
13.	<i>Cercospora amorphophalli</i>	<i>Amorphophallus campanulatus</i>	19-07-03	St. Estevam	GUBH-P55
14.	<i>Cercospora apii</i>	<i>Impatiens</i> sp.	24-05-03	Banastari	GUBH-P32
15.	<i>Cercospora arisaemae</i>	<i>Arisaema sivasadanii</i>	17-07-04	Sawantwadi	GUBH-P156
16.	<i>Cercospora caladii</i>	<i>Colocasia antiquorum</i>	19-07-03	St. Estevam	GUBH-P54
17.	<i>Cercospora canescence</i>	<i>Vigna catjang</i>	08-06-03	Caranzalem	GUBH-P37
18.	<i>Cercospora canscorina</i>	<i>Canscora diffusa</i>	29-11-03	Amboli	GUBH-P117
19.	<i>Cercospora capsicigena</i>	<i>Capsicum annum</i>	07-04-04	Banastri	GUBH-P125
20.	<i>Cercospora citrullina</i>	<i>Coccinia grandis</i>	31-05-03	Corjuvem	GUBH-P36
21.	<i>Cercospora coicis</i>	<i>Coix</i> sp.	13-02-05	Carambolim	GUBH-P102
22.	<i>Cercospora colocasiae</i>	<i>Colocasia antiquorum</i>	19-07-03	St. Estevam	GUBH-P54

23.	<i>Cercospora erythrinicola</i>	<i>Erythrina indica</i>	13-11-03	Donapaula	GUBH-P112
24.	<i>Cercospora fukushiana</i>	<i>Impatiens pulcherrima</i>	13-09-03	Amboli	GUBH-P82
25.	<i>Cercospora gerberae</i>	<i>Gerbera</i> sp.	12-08-04	NIO Campus	GUBH-P165
26.	<i>Cercospora hydrocotyles</i>	<i>Centella asiatica</i>	12-08-04	Banastari	GUBH-P172
27.	<i>Cercospora kikuchii</i>	<i>Vigna unguiculata</i>	15-03-03	Banastari	GUBH-P25
28.	<i>Cercospora mackenziei</i> sp. nov.	<i>Mackenzia integrifolia</i>	27-09-03	Tambdi Surla	GUBH-P101
29.	<i>Cercospora physalidis-minima</i>	<i>Physalis minima</i>	22-06-04	Calem	GUBH-P137
30.	<i>Cercospora timorensis</i>	<i>Ipomoeae pes-caprae</i>	15-08-03	Panjim	GUBH-P64
31.	<i>Cercospora vanderystii</i>	<i>Blumia</i> sp.	19-07-03	Amboli	GUBH-P84
32.	<i>Cercospora</i> sp.1	<i>Dioscorea bulbifera</i> .	26-06-04	Calem	GUBH-P141
33.	<i>Cercospora</i> sp. 2	<i>Ipomoea</i> sp.	16-07-04	Banastari	GUBH-P152
34.	<i>Cercospora</i> sp. 3	<i>Spermacose</i> sp.	17-07-04	Amboli	GUBH-P158
35.	<i>Cercospora</i> sp. 4	<i>Ipomoea</i> sp.	21-10-04	Banastari	GUBH-P177
36.	<i>Cercospora</i> sp. 5	<i>Cryptocorin</i> sp.	13-02-04	Mashem	GUBH-P220
37.	<i>Cercospora</i> sp. 6	<i>Jasminum</i> sp.	15-03-03	Banastari	GUBH-P22
38.	<i>Cercospora</i> sp. 7	<i>Coccinia indica</i>	08-06-03	Banastari	GUBH-P38
39.	<i>Cercospora</i> sp. 8	<i>Cucumis trigonus</i>	28-08-03	GU Campus	GUBH-P68
40.	<i>Cercospora</i> sp. 9	<i>Paracaryum</i> sp.	13-09-03	Amboli	GUBH-P80
41.	<i>Cercospora</i> sp. 10	<i>Amorphophallous campanulatus</i>	13-09-03	Amboli	GUBH-P81
42.	<i>Cercospora</i> sp. 11	<i>Blumea</i> sp.	10-11-04	Amboli	GUBH-P84
43.	<i>Chaetopsina indica</i> sp. nov.	<i>Careya arborea</i>	27-09-03	Tambdi Surla	GUBH-P95
44.	<i>Chalara indica</i> sp. nov.	<i>Areca catechu</i>	12-07-03	Kesarwal	GUBH-P49
45.	<i>Cladosporium caryotii</i> sp. nov.	<i>Caryota urens</i>	13-02-05	Cotigao	GUBH-P225
46.	<i>Cladosporium semicarpie</i> sp. nov	<i>Semicarpus anacardium</i>	21-01-05	Yana	GUBH-P209

47.	<i>Cordana musae</i>	<i>Musa paradisiaca</i>	13-07-03	Sigao	GUBH-P51
48.	<i>Corynespora calicioidea</i>	<i>Macanzea</i> sp.	13-09-03	Amboli	GUBH-P86
49.	<i>Corynespora cassiicola</i>	<i>Helicteres isora</i>	25-07-03	Castle rock	GUBH-P160
50.	<i>Corynespora cucurbitaecola</i>	<i>Cucumis sativus</i>	03-09-03	Colem	GUBH-P74
51.	<i>Corynespora elaeidicola</i>	<i>Calamus</i> sp.	27-09-03	Tambdi Surla	GUBH-P100
52.	<i>Corynespora ghatensis</i> sp. nov	<i>Calamus</i> sp.	21-01-05	Yana	GUBH-P201
53.	<i>Corynespora ligustri</i>	<i>Jasminum</i> sp.	15-03-03	Banastari	GUBH-P23
54.	<i>Corynespora nana</i>	<i>Lantana camara</i>	16-06-04	GU Campus	GUBH-P131
55.	<i>Corynespora yanensis</i> sp. nov	<i>Vitex</i> sp.	21-01-05	Yana	GUBH-P200
56.	<i>Corynespora</i> sp. 1	<i>Vitex nigundo</i>	19-07-03	St. Estevam	GUBH-P52
57.	<i>Corynespora</i> sp. 2	<i>Carissa carandas</i>	19-02-03	GU Campus	GUBH-P17
58.	<i>Corynespora</i> sp. 3	<i>Allamanda cathartica</i>	15-08-03	Campal	GUBH-P63
59.	<i>Corynespora</i> sp. 4	<i>Cucumis trigonus</i>	28-08-03	GU Campus	GUBH-P66
60.	<i>Corynespora</i> sp. 5	<i>Momordica charantia</i>	22-06-04	Calem	GUBH-P133
61.	<i>Curvularia ovoidea</i>	<i>Ficus bengalensis</i>	25-01-03	GU Campus	GUBH-P14
62.	<i>Curvularia trifolii</i>	<i>Saccharum officinarum</i>	02-07-04	Paryem	GUBH-P147
63.	<i>Cylindrocladium</i> sp.	<i>Helicteris isora</i>	26-08-04	Colem	GUBH-P167
64.	<i>Dactylella ellipsospora.</i>	<i>Mangifera indica</i>	05-07-03	Valpoi	GUBH-P41
65.	<i>Deightoniella torulosa</i>	<i>Musa paradisiaca</i>	19-07-03	St. Estevam	GUBH-P53
66.	<i>Denticularia modesta</i>	<i>Anacardium occidentale</i>	13-02-05	Mashem	GUBH-P223
67.	<i>Diplococcium spicatum</i>	<i>Areca catechu</i>	19-11-03	Banastari	GUBH-P116
68.	<i>Doratomyces nanus</i>	<i>Calamus</i> sp.	02-08-03	Bondla	GUBH-P58
69.	<i>Drechslera cynodontis</i>	<i>Tecoma stans</i>	16-06-04	GU campus	GUBH-P130
70.	<i>Excipularia narsapurensis</i>	<i>Mangifera indica</i>	05-07-03	Valpoi	GUBH-P46
71.	<i>Fusarium heterosporum.</i>	<i>Justicia adathoda</i>	08-10-03	GU Campus	GUBH-P104
72.	<i>Fusarium sambucinum</i>	<i>Justicia adathoda</i>	16-04-03	Banastari	GUBH-P29
73.	<i>Fusarium</i> sp.	<i>Flacourtia</i> sp.	21-01-05	Yana	GUBH-P206

74.	<i>Gonatobotryum epiphyticum</i> sp. nov.	<i>Nothopegia colebrookiana</i>	21-01-05	Yana	GUBH-P207
75.	<i>Gonatophragmium mori</i>	<i>Ficus asperrima</i>	25-01-05	Puttur	GUBH-P214
76.	<i>Hansfordia pulvinata</i>	<i>Ficus bengalensis</i>	25-01-03	GU Campus	GUBH-P13
77.	<i>Hermatomyces tucumanensis</i>	<i>Mangifera indica</i>	03-09-03	Colem	GUBH-P75
78.	<i>Isaria</i> sp.	<i>Mangifera indica</i>	05-07-03	Valpoi	GUBH-P43
79.	<i>Janetia</i> sp.	<i>Ficus asperrima</i>	06-02-05	Nanoda	GUBH-P218
80.	<i>Kramasamuha sibika</i>	<i>Careya arborea</i>	21-01-03	Banastari	GUBH-P10
81.	<i>Menisporopsis theobromae</i>	<i>Nothopegia colebrookiana</i>	02-07-04	Forest at Chorla	GUBH-P142
82.	<i>Monodictys</i> sp.	<i>Psidium guajava</i>	03-09-03	Colem	GUBH-P72
83.	<i>Mycovellosiella eupatorii-odorati</i>	<i>Chromolina odorata</i>	01-01-03	Banastari	GUBH-P1
84.	<i>Myrothecium</i> sp.	<i>Hibiscus rosa-sinensis</i>	03-09-03	Colem	GUBH-P73
85.	<i>Nigrospora</i> sp.	<i>Erythrina indica</i>	13-11-03	Donapaula	GUBH-P113
86.	<i>Passalora persanata</i>	<i>Arachis hypogea</i>	10-04-04	ICAR campus	GUBH-P126
87.	<i>Passalora bougainvilleae</i>	<i>Bougainvilleae spectabilis</i>	01-01-03	GU Campus	GUBH-P3
88.	<i>Passalora gliricidiasis</i>	<i>Gliricidia sepium</i>	25-08-03	Banastari	GUBH-P65
89.	<i>Passalora</i> sp.	<i>Vigna unguiculata</i>	15-03-03	Banastari	GUBH-P26
90.	<i>Periconia byssoides</i>	<i>Grewia microcos</i>	07-01-03	Banastari	GUBH-P9
91.	<i>Periconiella heveae</i>	<i>Calicopteris floribunda</i>	16-01-05	Colem	GUBH-P195
92.	<i>Periconiella velutina</i>	<i>Anacardium occidentale</i>	10-03-03	Pilgao	GUBH-P21
93.	<i>Periconiella</i> sp. 1	<i>Mangifera indica</i>	12-07-03	Kesarwal	GUBH-P48
94.	<i>Periconiella</i> sp.2	<i>Nothopegia colebrookiana</i>	21/01/05	Yana	GUBH-P197
95.	<i>Periconiella</i> sp.3	<i>Hopea whightiana</i>	19-02-04	Valpoi	GUBH-P121
96.	<i>Phaeoramularia leeeae</i>	<i>Leea</i> sp.	26-12-04	Ambheghat	GUBH-P184
97.	<i>Phaeotrichoconis</i> sp.	<i>Ageratum conyzoides</i>	22-06-04	Calem	GUBH-P136
98.	<i>Phalangispora</i> sp.	<i>Holarrhena pubescens</i>	03-09-03	Molem	GUBH-P77
99.	<i>Pithomyces maydicus</i>	<i>Ficus bengalensis</i>	25-01-03	GU Campus	GUBH-P12
100.	<i>Pithomyces</i> sp.	<i>Vigna</i> sp.	22-09-03	GU Campus	GUBH-P92

101	<i>Pseudocercospora abelmoschi</i>	<i>Abelmoschus esculentus</i>	31-05-03	Corjuvem	GUBH-P35
102.	<i>Pseudocercospora adinicola</i>	<i>Adina cordifolia</i>	26-09-04	Bondla	GUBH-P175
103.	<i>Pseudocercospora anacardi</i>	<i>Anacardium occidentale</i>	06-02-05	Nanoda	GUBH-P219
104.	<i>Pseudocercospora angulo-maculae</i>	<i>Ficus asperrima</i>	06-02-05	Nanoda	GUBH-P217
105.	<i>Pseudocercospora careyae</i>	<i>Careya arborea</i>	29-11-03	Sawantwadi	GUBH-P118
106.	<i>Pseudocercospora catappae</i>	<i>Terminalia catappa</i>	01-01-03	GU Campus	GUBH-P2
107.	<i>Pseudocercospora corchorifoliae</i>	<i>Melochia corchorifoliae</i>	19-07-03	St. Estevam	GUBH-P57
108.	<i>Pseudocercospora crotalariae</i>	<i>Crotalaria striata</i>	31-05-03	Corjuvem	GUBH-P34
109.	<i>Pseudocercospora cruenta</i>	<i>Vigna catjang</i>	31-05-03	Korjuvem	GUBH-P33
110.	<i>Pseudocercospora fagarae</i>	<i>Zanthoxylum rhetsa</i>	26-12-04	Polem	GUBH-P179
111.	<i>Pseudocercospora helleri</i>	<i>Sphenoclea zeylanica</i>	13-10-04	St. Cruz	GUBH-P176
112.	<i>Pseudocercospora holarrhenae</i>	<i>Holarrhena pubescens</i>	01-01-03	Banastari	GUBH-P4
113.	<i>Pseudocercospora jasminicola</i>	<i>Jasminum sp.</i>	15-07-04	Curca	GUBH-P151
114.	<i>Pseudocercospora maesae</i>	<i>Maesa indica</i>	26-09-04	Bondla	GUBH-P174
115.	<i>Pseudocercospora puderi</i>	<i>Rosa sp.</i>	04-09-04	Navelim	GUBH-P171
116.	<i>Pseudocercospora rhamnaceicola</i>	<i>Ziziphus oenoplia</i>	27-09-03	Tambadi Surla	GUBH-P99
117.	<i>Pseudocercospora stahlii</i>	<i>Passiflora foetida</i>	10-10-03	Bambolim	GUBH-P105
118.	<i>Pseudocercospora tabernaemontanae</i>	<i>Tabernaemontana sp.</i>	27-09-03	Tambdi Surla	GUBH-P96
119.	<i>Pseudocercospora tectonicola</i>	<i>Tectona grandis</i>	16-10-04	Mashem	GUBH-P178

120.	<i>Pseudocercospora viticigena</i>	<i>Vitex</i> sp.	13-02-05	Mashem	GUBH-P224
121.	<i>Pseudocercospora</i> sp. 1	<i>Wendlandia thyrsodea</i>	19-02-04	Valpoi	GUBH-P122
122.	<i>Pseudocercospora</i> sp. 2	<i>Achras sapota</i>	22-06-04	Calem	GUBH-P139
123.	<i>Pseudocercospora</i> sp. 3	<i>Jasminum malabaricum</i>	02-07-04	Chorla	GUBH-P146
124.	<i>Pseudocercospora</i> sp. 4	<i>Cosmostigma racemosa</i>	09-07-04	St. Estevem	GUBH-P150
125.	<i>Pseudocercospora</i> sp. 5	<i>Ficus arnottiana</i>	17-07-04	Amboli	GUBH-P157
126.	<i>Pseudocercospora</i> sp. 6	<i>Garcinia indica</i>	31-07-04	Colem	GUBH-P164
127.	<i>Pseudocercospora</i> sp. 7	<i>Adina cordifolia</i>	26-12-04	Polem	GUBH-P180
128.	<i>Pseudocercospora</i> sp. 8	<i>Adina cordifolia</i>	26-12-04	Hankani	GUBH-P183
129.	<i>Pseudocercospora</i> sp. 9	Undetermined	16-01-05	Colem	GUBH-P190
130.	<i>Pseudocercospora</i> sp. 10	<i>Azadirachta indica</i>	19-11-03	Banastari	GUBH-P115
131.	<i>Pseudocercospora</i> sp.11	<i>Elephantopus scaber</i>	29-11-03	Sawantwadi	GUBH-P119
132.	<i>Pseudocercospora</i> sp.12	<i>Vitex nigundo</i>	29-11-03	Amboli	GUBH-P120
133.	<i>Pseudocercospora</i> sp.13	<i>Anacardium occidentale</i>	22-06-04	Calem	GUBH-P134
134.	<i>Pseudocercospora</i> sp. 1	<i>Jasminum auriculatum</i>	07-01-03	Banastari	GUBH-P8
135.	<i>Pseudocercospora</i> sp.2	<i>Sesamum mulayanum</i>	02-07-04	GU Campus	GUBH-P148
136.	<i>Pseudophaeoramularia</i> sp.	<i>Dendrophthoe</i> sp.	13-02-05	Cotigao	GUBH-P221
137.	<i>Pseudospiropes</i> sp.	<i>Dendrocalamus</i> sp.	21-01-05	Yana	GUBH-P211
138.	<i>Pyricularia oryzae</i>	<i>Ischaemum</i> sp.	19-07-03	St. Estevam	GUBH-P56
139.	<i>Pyriculariopsis</i> sp.	<i>Leea</i> sp.	26-08-04	Colem	GUBH-P169
140.	<i>Sarcinella</i> sp.	<i>Bauhinia</i> sp.	03-09-03	Colem	GUBH-P71
141.	<i>Scolecobasidium constrictum</i>	<i>Ariopsis peltata</i>	17-07-04	Sawantwadi	GUBH-P159
142.	<i>Sirosporium carissae</i>	<i>Carissa carandas</i>	06-04-03	Banastari	GUBH-P28
143.	<i>Spiralum helicosporum</i>	<i>Psychotria dalzellii</i>	16-08-03	Cotigao	GUBH-P61
144.	<i>Spiropes capensis</i>	<i>Ficus asperrima</i>	06-02-05	Nanoda	GUBH-P216
145.	<i>Spiropes clavatus</i>	<i>Memecylon</i> sp.	02-07-04	Chorla	GUBH-P144
146.	<i>Spiropes guareicola</i>	<i>Citrus</i> sp.	31-08-04	Shigao	GUBH-P170
147.	<i>Spiropes helleri</i>	<i>Careya arborea</i>	21-01-05	Yana	GUBH-P202
148.	<i>Spiropes</i> sp.1	<i>Lagestroemia</i> sp.	13-09-03	Sawantwadi	GUBH-P85

149.	<i>Spiropes</i> sp.2	<i>Diospyrus</i> sp.	21-01-05	Yana	GUBH-P208
150.	<i>Sporidesmium adscendens</i>	<i>Ixora coccinea</i>	19-02-04	Valpoi	GUBH-P123
151.	<i>Sporodesmium coronatum</i>	<i>Mangifera indica</i>	03-09-03	Colem	GUBH-P76
152.	<i>Sporidesmium</i> sp.	<i>Calamus</i> sp.	27-09-03	Tambdi Surla,	GUBH-P98
153.	<i>Stachybotrys kampalensis</i>	<i>Mangifera indica</i>	05-07-03	Valpoi	GUBH-P44
154.	<i>Stenella smilacis</i>	<i>Smilax zeylanica</i>	07-01-03	Banastari	GUBH-P6
155.	<i>Stenella</i> sp. 1	<i>Grewia microcos</i>	05-07-03	Valpoi	GUBH-P47
156.	<i>Stenella</i> sp. 2	<i>Strychnos nux-vomica</i>	16-01-05	Colem	GUBH-P193
157.	<i>Stenella</i> sp. 3	<i>Vitex</i> sp.	21-01-05	Yana	GUBH-P199
158.	<i>Stenella</i> sp. 4	<i>Ixora</i> sp.	13-02-05	Cotigao	GUBH-P226
159.	<i>Stigmina mangiferae</i>	<i>Mangifera indica</i>	17-03-04	Kodal	GUBH-P124
160.	<i>Tomrnticola</i> sp.	<i>Strychnos nux-vomica</i>	16-01-05	Colem	GUBH-P192
161.	<i>Torula herbarum</i>	<i>Alstonia scholaris</i>	27-07-04	GU Campus	GUBH-P162
162.	<i>Trichothecium</i> sp.	<i>Syzygium cumini</i>	19-02-03	Banastari	GUBH-P16
163.	<i>Vermiculariopsiella elegans.</i>	<i>Plumeria</i> sp.	22-09-03	Diwar	GUBH-P93
164.	<i>Verticillium</i> sp.	<i>Flocourtia</i> sp.	21-01-05	Yana	GUBH-P210
165.	<i>Zygosporium masonii</i>	<i>Mangifera indica</i>	16-06-04	GU Campus	GUBH-P132
166.	<i>Zygosporium oscheoides</i>	<i>Careya arborea</i>	14-05-03	Assagao	GUBH-P30
167.	Undetermined taxon 1	<i>Alstonia scholaris</i>	27-07-04	GU campus	GUBH-P161
168.	Undetermined taxon 2	<i>Semicarpus</i> sp.	21-01-05	Yana	GUBH-P215
169.	Undetermined taxon 3	<i>Plumeria</i> sp.	03-09-03	Colem	GUBH-P79
170.	Undetermined taxon 4	<i>Artocarpus incisa</i>	22-06-04	Calem	GUBH-P138
171.	Undetermined taxon 5	<i>Pongamia pinnata</i>	14-05-03	Assagao	GUBH-P31

172	Undetermined taxon 6	<i>Ixora sp.</i>	22-06-04	Calem	GUBH-P140
173.	Undetermined taxon 7	<i>Randia domentorum</i>	18-09-03	Amboli	GUBH-P83
174.	Undetermined taxon 8	<i>Careya arborea</i>	27-09-03	Colem	GUBH-P94
175.	Undetermined taxon 9	<i>Syzygium sp.</i>	27-09-03	Tambdi Surla	GUBH-P45
176.	Undetermined taxon 10	<i>Memycelon sp.</i>	27-09-03	Tambdi Surla	GUBH-P145
177.	Undetermined taxon 11	<i>Dendrocalamus sp.</i>	21-01-05	Yana	GUBH-P212

Table 2: List of foliicolous Coelomycetes documented during the course of study:

No.	Coelomycetes	Plant Substrate/Host	Date of Collection	Locality	Herb. No.
1.	<i>Chaetomella raphigera</i>	Dendrocalamus sp.	16-01-05	Colem	GUBH-P91
2.	<i>Colletotrichum capsici</i>	<i>Pithecelobium dulce</i>	01-01-03	GU campus	GUBH-P5
3.	<i>Phoma ziziphii sp. nov</i>	<i>Zizyphus mauritiana</i>	21/01/03	GU campus	GUBH-P11
4.	<i>Pestalotopsis palmarum</i>	<i>Careya arborea</i>	01-03-03	GU campus	GUBH-P19
5.	<i>Polychaeton sp. 1</i>	<i>Michelia champaca</i>	03-09-03	Colem	GUBH-P69
6.	<i>Polychaeton sp. 2</i>	<i>Terminalia catappa</i>	09-11-03	Pangim	GUBH-P111
7.	<i>Septoria arcuata</i>	<i>Ficus bengalensis</i>	18-10-03	Pilerna	GUBH-P107
8.	<i>Uredo sp.</i>	<i>Phyllanthus sp.</i>	05-11-03	GU Campus	GUBH-P110
9	Undetermined taxon 12	<i>Garcinia indica</i>	01-01-03	GU Campus	GUBH-P20
10.	Undetermined taxon 13	<i>Bridelia sp.</i>	01-01-03	GU Campus	GUBH-P88
13.	Undetermined taxon 14	<i>Solanum melongena</i>	01-01-03	GU Campus	GUBH-P109
14	Undetermined taxon 15	<i>Psychotria dalzellii</i>	16-08-03	Cotigao	GUBH-P62

Table 3: List of foliicolous Ascomycetes documented during the course of study:

No.	Ascomycetes	Plant Substrate/Host	Date of Collection	Locality	Herb. No.
1.	<i>Asterina lawsoniae</i>	<i>Lawsonia inermis</i>	19-02-03	Banastari	GUBH-P103
2.	<i>Botryosphaeria</i> sp.	<i>Careya arborea</i>	27-09-03	Tambdi Surla	GUBH-P97
3.	<i>Meliola holarrhenae</i>	<i>Holarrhena pubescens</i>	19-02-03	Banastari	GUBH-P18
4.	<i>Meliola</i> sp.	<i>Memycelon</i> sp.	07-06-04	Banastari	GUBH-P127
5.	<i>Parodiella hedysari</i>	<i>Desmodium trifolium</i>	09-07-04	GU Campus	GUBH-P149
6.	<i>Phyllachora ixorae</i>	<i>Ixora</i> sp.	21-01-05	Yana	GUBH-P205
7.	<i>Phyllachora</i> sp.	<i>Abrus precatorius</i>	16-01-05	Colem	GUBH-P186
8.	Undetermined taxon 16	<i>Mangifera indica</i>	05-07-03	Valpoi	GUBH-P42
9.	Undetermined taxon 17	<i>Areca catechu</i>	12-07-03	Kesarval	GUBH-P50
10.	Undetermined taxon 18	<i>Calamus</i> sp.	02-08-03	Bondla	GUBH-P59
11.	Undetermined taxon 19	<i>Calamus</i> sp.	02-08-03	Bondla	GUBH-P60
12.	Undetermined taxon 20	<i>Bridelia</i> sp.	13-09-03	Amboli	GUBH-P89
13.	Undetermined taxon 21	<i>Garcinia indica</i>	16-08-04	Mashem	GUBH-P166

Part II: Specificity of foliicolous fungi to their hosts

To examine the extent of host specificity of foliicolous fungi to the plant host, an unconventional method was set out. Infected leaves of a particular plant species showing similar symptoms were collected from more than 10 distantly located places during the tenure of the study. Leaf spots and the causal foliicolous fungus were studied microscopically for each sample. If the same fungus with similar symptoms was recorded from different places, in the range of 30% or more, it was assumed that the fungus might be specific to the host plant. Though Koch's Postulates (Rangaswamy, 1991) would have been ideal to confirm host specificity of the fungi, this method was not attempted in this study.

The results of this study are given in Table 4. The following fungi showed host specificity in the range of 30-60% (Fig. 203). The percentage of specificity of each fungus is given in parenthesis. *Acroconidiellina arecae* (40%), *Cercospora* sp.1 (20%), *Cercospora gerberae* (20%), *Cercospora hydrocotyles* (20%), *Cercospora* sp.6 (20%), *Cercospora kikuchii* (20%), *Cercospora vanderystii* (40%), *Cercospora canescence* (30%), *Cercospora* sp.7 (20%), *Cercospora amorphophalli* (20%), *Cercospora* sp.9 (20%), *Cercospora* sp.11 (20%), *Chalara indica* (30%), *Cordana musae* (20%), *Corynespora* sp. 2 (20%), *Corynespora* sp.3 (30%), *Kramasamuha sibika* (20%), *Mycovellosiella eupatori-odoratii* (60%), *Passalora bougainvilliae* (30%), *Periconia byssoides* (20%), *Periconiella velutina* (20%), *Pseudocercospora catappae* (30%), *Pseudocercospora holarrhenae* (30%), *Pseudocercospora crotalariana* (40%), *Pseudocercospora abelmoschi* (40%), *Pseudocercospora rhamnaceicola* (30%), *Pseudocercospora careyae* (50%), *Pseudocercospora* sp.12 (40%), *Pseudocercospora* sp.11 (40%), *Pseudocercospora* sp.1 (30%), *Scolecobasidium constrictum* (30%), *Stenella smilacis* (40%) and *Stigmina mangiferae* (20%).

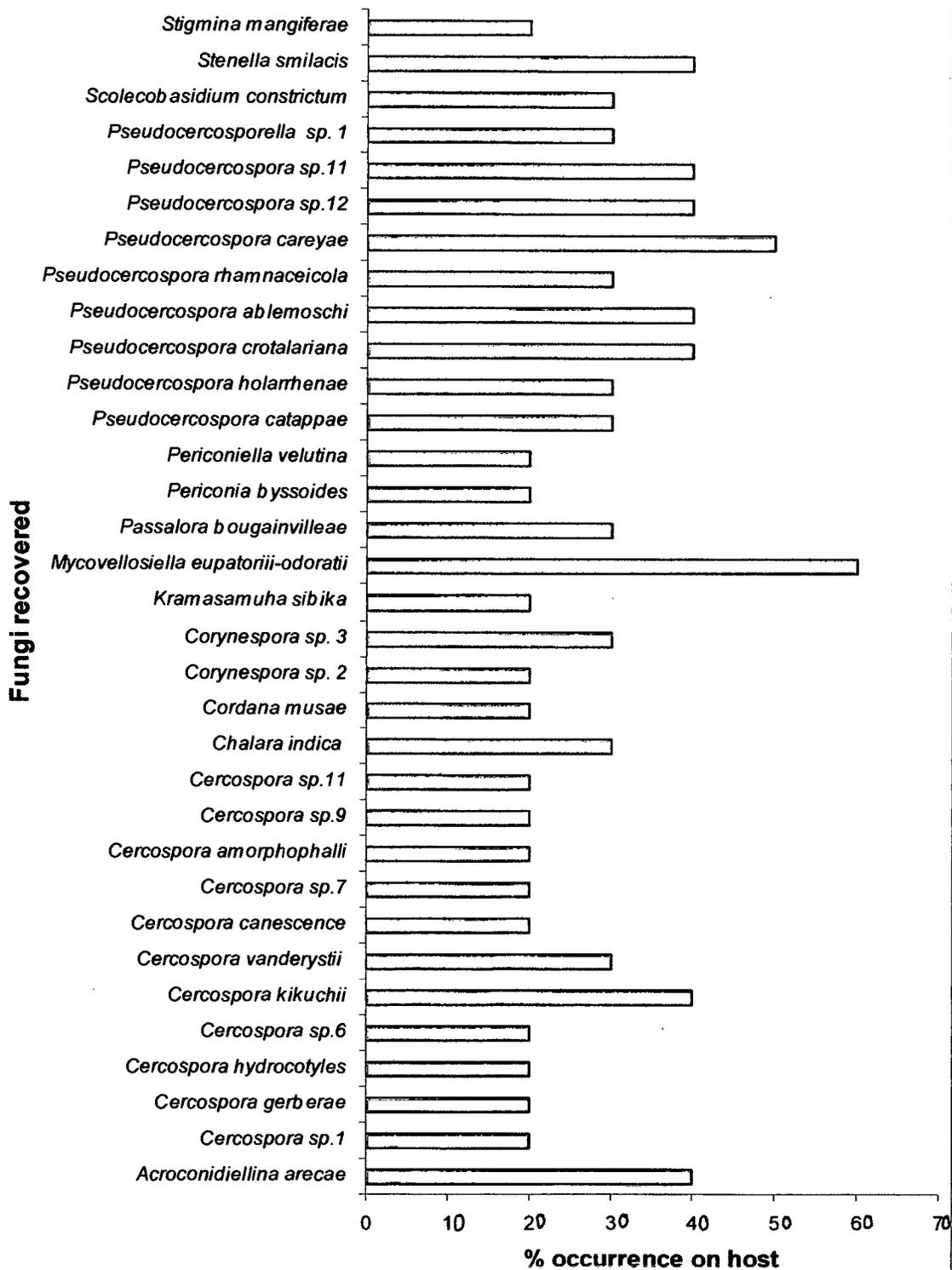
Table 4: Specificity of foliicolous fungi to their hosts

Sr. No.	Fungi Identified	Host plant	Date of collection	Locality	Percent specificity
1.	<i>Acroconidiellina arecae</i>	<i>Areca catechu</i>	03-09-03	Colem	40%
			02-07-04	Paryem	
			14-10-04	Calem	
			16-10-04	Mashem	
2.	<i>Cercospora</i> sp.1	<i>Dioscorea bulbifera</i>	26-06-04	Banastari	20%
			22-10-04	Calem	
3.	<i>Cercospora gerberae</i>	<i>Gerbera</i> sp.	12-08-04	NIO Campus	20%
			21-10-04	Banastari	
4.	<i>Cercospora hydrocotyles</i>	<i>Centella asiatica</i>	06-09-04	Mashem	20%
			17-06-04	Banastari	
5.	<i>Cercospora</i> sp. 6	<i>Jasminum</i> sp.	15-03-03	Banastari	20%
			16-10-04	Mashem	
6.	<i>Cercospora kikuchii</i>	<i>Vigna unguiculata</i>	15-03-03	Banastari	20%
			31-05-03	Corjuvem	
			08-06-03	Caranzalem	
			22-06-04	Calem	
7.	<i>Cercospora vanderystii</i>	<i>Vigna unguiculata</i>	15-03-03	Banastari	30%
			31-05-03	Corjuvem	
			10-10-04	Mashem	
8.	<i>Cercospora canescence</i>	<i>Vigna catjang</i>	08-06-03	Caranzalem	20%
			08-11-04	Banastari	
9.	<i>Cercospora</i> sp. 7	<i>Coccinia indica</i>	08-06-03	Caranzalem	20%
			25-08-03	Banastari	
10.	<i>Cercospora amorphophalli</i>	<i>Amorphophallus campanulatus</i>	19-07-03	St. Estevam	20%
			02-11-04	Banastari	
11.	<i>Cercospora</i> sp. 9	<i>Paracaryum</i> sp.	13-09-03	Amboli	20%
			08-08-04	Valpoi	
12.	<i>Cercospora</i> sp. 11	<i>Blumea</i> sp.	13-09-03	Amboli	20%
			10-11-04	Calem	
13.	<i>Chalara indica</i>	<i>Areca catechu</i>	12-07-03	Kesarwal	30%
			06-06-04	Banastari	
			16-10-04	Mashem	
14.	<i>Cordana musae</i>	<i>Musa paradisiaca</i>	13-07-03	Sigao	20%
			25-09-04	Banastari	
15.	<i>Corynespora</i> sp. 2	<i>Carissa carandas</i>	19-02-03	Banastari	20%
			26-10-04	Hankoni	
16.	<i>Corynespora</i> sp. 3	<i>Allamanda cathartica</i>	15-08-03	Panjim	30%
			22-06-04	Calem	
			15-09-04	GU Campus	

17.	<i>Kramasamuha sibika</i>	<i>Careya arborea</i>	21-01-03	Banastari	20%
			05-07-03	Valpoi	
18.	<i>Mycovellosiella eupatorii-odoratii</i>	<i>Chromolina odoratum</i>	01-01-03	Banastari	60%
			10-03-03	Pilgao	
			26-02-04	GU Campus	
			16-10-04	Mashem	
			03-07-05	Colem	
			08-07-05	Bondla	
19.	<i>Passalora bougainvilliae</i>	<i>Bougainvillaea spectabilis</i>	01-01-03	GU Campus	30%
			14-05-03	Asagao	
			16-08-03	Campal	
20.	<i>Periconia byssoides</i>	<i>Microcos paniculata</i>	07-01-03	Banastari	20%
			10-03-03	Pilgao	
21.	<i>Periconiella velutina</i>	<i>Anacardium occidentale</i>	10-03-03	Pilgao	20%
			25-08-03	Banastari	
22.	<i>Pseudocercospora catappae</i>	<i>Terminalia catappa</i>	01-01-03	GU Campus	30%
			09-11-03	Panjim	
			16-10-04	Mashem	
23.	<i>Pseudocercospora holarrhenae</i>	<i>Holarrhena pubescens</i>	01-01-03	Banastari	30%
			02-07-04	Paryem	
			16-01-05	Colem	
24.	<i>Pseudocercospora crotalariana</i>	<i>Crotalaria striata</i>	31-05-03	Korjuvem	40%
			08-06-03	Caranzalem	
			15-08-03	Miramar	
			12-09-03	Banastari	
25.	<i>Pseudocercospora abelmoschi</i>	<i>Hibiscus esculentus</i>	31-05-03	Korjuvem	40%
			08-06-03	Caranzalem	
			22-06-04	Calem	
			28-06-04	Banastari	
26.	<i>Pseudocercospora rhamnaceicola</i>	<i>Ziziphus oenoplia</i>	27-09-03	Tambadi Surla	30%
			20-10-03	Banastari	
			16-10-04	Mashem	
27.	<i>Pseudocercospora careyae</i>	<i>Careya arborea</i>	29-11-03	Sawantwadi	50%
			20-01-04	Banastari	
			26-12-04	Hankoni	
			16-01-05	Colem	
			09-07-05	Bondla	
28.	<i>Pseudocercospora sp. 12</i>	<i>Vitex nigundo</i>	29-11-03	Amboli	40%
			16-06-04	Asagao	
			02-07-04	Paryem	
			25-07-04	Valpoi	
29.	<i>Pseudocercospora sp.11</i>	<i>Elephantopus scaber</i>	29-11-03	Sawantwadi	40%
			02-07-04	Paryem	
			03-07-04	Colem	
			09-07-04	Bondla	
30.	<i>Pseudocercospora sp.1</i>	<i>Jasminum sp.</i>	07-01-03	Banastari	30%
			04-07-04	GU Campus	
			12-08-04	Margao	

31.	<i>Scolecobasidium constrictum</i>	<i>Ariopsis peltata</i>	17-07-04	Amboli	20%
			18-08-04	St. Estivum	
			20-08-04	Banastari	
32.	<i>Stenella smilacis</i>	<i>Smilax zeylanica</i>	07-01-03	Banastari	40%
			16-10-04	Mashem	
			26-10-04	Polem	
			16-01-05	Calem	
33.	<i>Stigmina mangiferae</i>	<i>Mangifera indica</i>	17-03-04	Kodal	20%
			02-07-04	Paryem	

Fig. 203: Host association of foliicolous fungi



Part III: Screening of foliicolous fungi for production of enzymes:

Degradative enzymes produced by leaf-inhabiting fungi have an important role to play in the process of infection of the host and establishment of disease symptoms on the leaf in the form of leaf spots. The ability of the fungus to produce enzymes was tested in the laboratory generally on solid agar medium. The medium was incorporated with specific nutrient substrate on which the test was subsequently conducted. The qualitative assays were made, by measuring the diameter of the clearing zone formed around the fungal colonies on solid medium, after 5-7 days of incubation.

All the 50 species of foliicolous fungi, isolated from different host plants and brought into culture, were screened for their ability to produce three important enzymes involved in plant pathogenesis, viz. cellulase, lipase and pectinase. The methods followed were described in detail in Chapter III. The enzyme secreted by the fungi on solid medium was measured qualitatively on the basis of presence or absence of a 'clear zone' that indicated degradation of the substrate. The extent of the clear zone was measured in centimeters and categorized into 3 kinds, as low, moderate and high activity. The results of enzyme tests carried out on all fungi are given in Table 5.

Results show that all the 50 species of fungi are positive for lipase (100%), 31 for cellulase (62%), and 25 for pectinase (50%) activity (Fig.204). Seventeen species elaborated all the 3 enzymes (34%) whereas a few were found to produce exclusively a particular enzyme, i.e. 10 isolates were positive for only lipase (20%). Of the lipase producing fungi, 45 exhibited 'low', 4 showed 'moderate' and 1 was with 'high' activity. Of all the fungi tested, some showed 'low' and remaining exhibited no activity for

cellulase. For pectinase, only one showed 'moderate' and remaining exhibited either low or no activity.

From the data obtained, it can be seen that most of the conventionally recognized foliicolous fungi did not exhibit the ability to produce pectinase but all of them were positive for lipase activity. Whereas, most of those hitherto litter fungi isolated as foliicolous in this work showed ability to produce all the three enzymes. Most species of *Cercospora* exhibited the ability to produce cellulase. Similarly, many species of *Pseudocercospora* did not show cellulase activity.

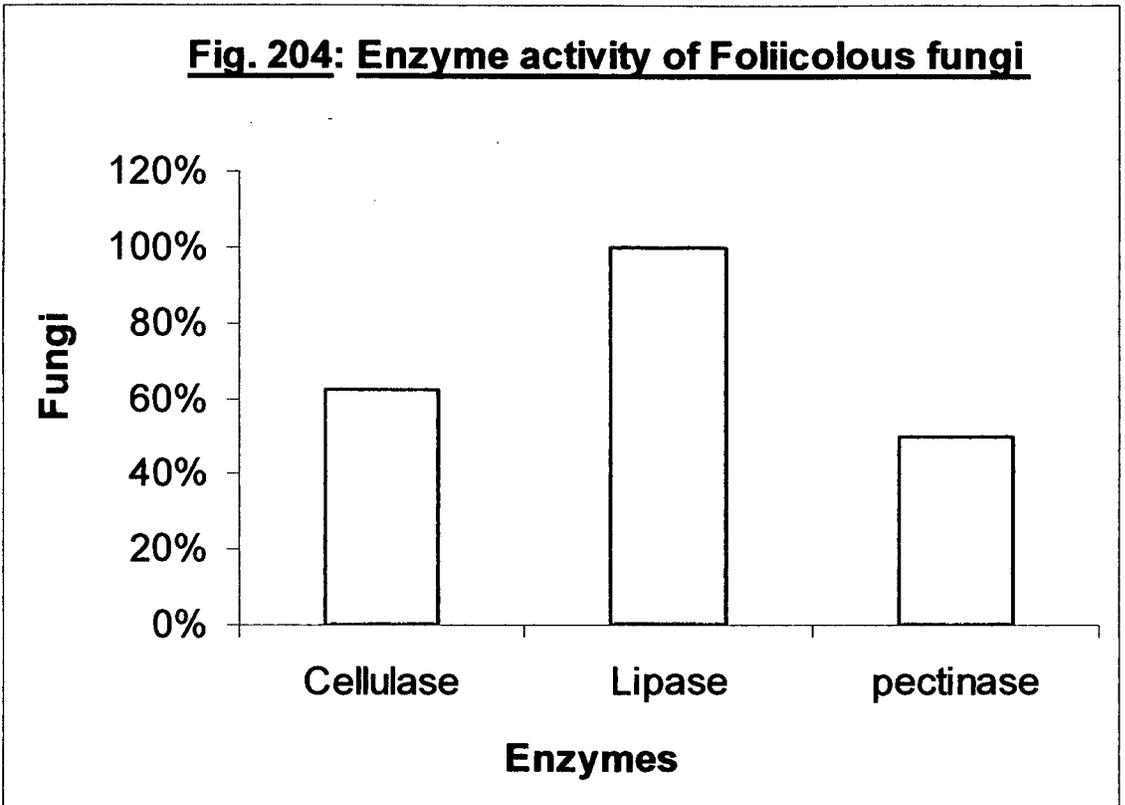
Table 5: Enzyme activity of foliicolous fungi

No.	Fungi isolated	Host plant	Cellulase	Lipase	Pectinase
1.	<i>Acremonium</i> sp.	<i>Calicopteris floribunda</i>	+	++	-
2.	<i>Acroconidiellina arecae</i>	<i>Areca catechu</i>	-	+	-
3.	<i>Bahusutrabeeja dwaya</i>	<i>Malotus phillipinensis</i>	-	+	+
4.	<i>Bahusutrabeeja manoharacharii</i>	<i>Bridelia scandens</i>	-	+	-
5.	<i>Beltraniella portoricensis</i>	<i>Bridelia</i> sp.	+	+	+
6.	<i>Cercospora arisaemae</i>	<i>Arisaema sivasadanii</i>	-	+	+
7.	<i>Cercospora hydocotyles</i>	<i>Centella asiatica</i>	+	++	++
8.	<i>Cercospora</i> sp. 2	<i>Ipomoea</i> sp.	+	+	-
9.	<i>Cercospora</i> sp. 7	<i>Coccinia indica</i>	+	+	-
10.	<i>Cercospora</i> sp. 9	<i>Paracaryum</i> sp.	+	+	-
11.	<i>Chaetomiella raphigera</i>	<i>Dendrocalamus</i> sp.	+	+	-
12.	<i>Colletotrichum capsici</i>	<i>Pithecellobium dulce</i>	+	+	+
13.	<i>Corynespora ghatensis</i>	<i>Calamus</i> sp.	+	+	+
14.	<i>Corynespora yanensis</i>	<i>Vitex</i> sp.	+	+	+
15.	<i>Curvularia ovoidea</i>	<i>Ficus bengalensis</i>	+	+	+
16.	<i>Doratomyces nanus</i>	<i>Calamus</i> sp.	+	++	+
17.	<i>Fusarium</i> sp.	<i>Flocourtia</i> sp.	+	+	-
18.	<i>Gonatobotryum epiphyticum</i>	<i>Nothopegia colebrookiana</i>	+	+++	-
19.	<i>Gonatophragmium mori</i>	<i>Ficus asperrima</i>	+	+	-
20.	<i>Hansfordia pulvinata</i>	Undetermined	-	++	+
21.	<i>Menisporopsis theobromae</i>	<i>Nothopegia colebrookiana</i>	-	+	-

22.	<i>Mycovellosiella eupatorii-odoratii</i>	<i>Chromolina sp.</i>	+	+	-
23.	<i>Myrothecium roridum</i>	<i>Hibiscus rosa-sinensis</i>	+	+	+
24.	<i>Parodiella hedydari</i>	<i>Desmodium trifolium</i>	+	+	+
25.	<i>Passalora bougainvilleae</i>	<i>Bougainvillea spectabilis</i>	+	+	-
26.	<i>Periconiella heveae</i>	<i>Calicopteryx floribunda</i>	-	+	+
27.	<i>Periconiella sp. 3</i>	<i>Nothopegia colebrookiana</i>	+	+	+
28.	<i>Phyllachora ixorii</i>	<i>Ixora coccinea</i>	-	+	+
29.	<i>Pithomyces maydicus</i>	<i>Ficus bengalensis</i>	+	+	+
30.	<i>Pithomyces sp.</i>	<i>Vigna sp.</i>	+	+	+
31.	<i>Pseudocercospora abelmoschi</i>	<i>Hibiscus esculentus</i>	-	+	-
32.	<i>Pseudocercospora anacardii</i>	<i>Anacardium occidentale</i>	+	+	-
33.	<i>Pseudocercospora angulo-maculae</i>	<i>Ficus asperrima</i>	-	+	-
34.	<i>Pseudocercospora crotalariae</i>	<i>Crotalaria striata</i>	-	+	+
35.	<i>Pseudocercospora fagarae</i>	<i>Zanthoxylum rhetsa</i>	-	+	-
36.	<i>Pseudocercospora maesae</i>	<i>Maesa indica</i>	+	+	+
37.	<i>Pseudocercospora puderi</i>	<i>Rosa sp.</i>	+	+	-
38.	<i>Pseudocercospora sp. 10</i>	Undetermined	-	+	-
39.	<i>Pseudocercospora sp. 11</i>	<i>Elephantopus scaber</i>	-	+	-
40.	<i>Pseudocercospora sp. 3</i>	<i>Jasminum malabaricum</i>	-	+	+
41.	<i>Pseudocercospora sp.9</i>	Undetermined	-	+	-
42.	<i>Pseudocercospora tabernaemontanae</i>	<i>Tabernaemontana sp.</i>	+	+	-
43.	<i>Pyriculariopsis sp.</i>	<i>Leea sp.</i>	+	+	-
44.	<i>Spiropes guareicola</i>	<i>Citrus sp.</i>	-	+	-
45.	<i>Stachybotrys kampalensis</i>	<i>Mangifera indica</i>	+	+	+
46.	<i>Stenella sp.</i>	<i>Vitex sp.</i>	+	+	+
47.	<i>Tomrnticola sp.</i>	<i>Strychnos nux-vomica</i>	+	+	+
48.	Undetermined taxon 1	<i>Ficus sp.</i>	+	+	+
49.	Undetermined taxon 2	<i>Microcos paniculata</i>	-	+	-
50.	<i>Verticillium sp.</i>	<i>Flocourtia sp.</i>	-	+	+

Note: The activity of enzyme as denoted by the clearance zone in cm: 0.1-0.6 = +; 0.7-1.2 = ++; 1.3-2.0 = +++

Fig. 204: Enzyme activity of Follicolous fungi



DISCUSSION

The results presented in this thesis are based on a detailed investigation carried out on floristics, host specificity and enzyme activities of foliicolous fungi isolated from angiospermic (dicot and monocot) plants of Goa and neighbouring areas of Maharashtra and Karnataka, over a period of two and a half years from January 2003 to July 2005.

Regular field visits were conducted to different forested areas, vegetable and cereal crop fields, plantations, etc. to collect samples. In all 1725 samples of infected materials were gathered. Freshly gathered green leaves with epiphyllous and/or hypophyllous leaf spots constituted the sample material for isolation of foliicolous fungi. Infected leaves were observed under the stereomicroscope soon after sampling or subsequent to moist chamber incubation. Single spore isolation and infected tissue plating techniques were employed for recovery of foliicolous fungi in culture. This exercise resulted with the recovery of 202 fungi, belonging to 78 genera, which included Hyphomycetes (166 species in 66 genera), Coelomycetes (8 species in 7 genera) and Ascomycetes (7 species in 5 genera), besides a few undetermined forms (21). As can be seen, Hyphomycetes were the largest group of foliicolous fungi encountered in this study.

Floristic study:

The floristic report presented here embodied taxonomic descriptions of an unusually large number of microfungi isolated from green leaves. These included common, rare and novel forms. In this treatise, for our understanding, those foliicolous species frequently isolated from associative plants were considered as common forms; those encountered occasionally and sometimes only from endemic

plants of the region were treated as rare forms. Hitherto unknown species were, however, considered as novel forms.

In all, 202 species of fungi are described in detail with notes on their taxonomy, morphology, host association and specimens or cultures based on which descriptions were written. The fungi described are also illustrated with photomicrographs and camera lucida drawings. Specimens and cultures based on which the description of taxa made are deposited at the Herbarium of Botany Department, Goa University (GUBH) and the Goa University Fungus Culture Collection (GUFCC) respectively.

As can be seen, a total of 78 genera of fungi were documented in this study. Of these, the following 59 genera were represented by single species. *Acremonium*, *Acroconidiellina*, *Acrophialophora*, *Ardhachandra*, *Beltrania*, *Beltraniella*, *Ceeveesubramaniomyces*, *Ceratosporella*, *Chaetopsina*, *Chalara*, *Cordana*, *Cylindrocladium*, *Dactylella*, *Deightoniella*, *Denticularia*, *Diplococcium*, *Doratomyces*, *Drechslera*, *Excipularia*, *Gonatobotryum*, *Gonatophragmium*, *Hansfordia*, *Hermatomyces*, *Isaria*, *Janetia*, *Kramasamuha*, *Menisporopsis*, *Monodictys*, *Mycovellosiella*, *Nigrospora*, *Periconia*, *Myrothecium*, *Phaeoramularia*, *Phaeotrichoconis*, *Phalangispora*, *Pseudophaeoramularia*, *Pseudospirope*, *Pyricularia*, *Pyriculariopsis*, *Sarcinella*, *Scolecobasidium*, *Sirosporium*, *Spiralum*, *Stachybotrys*, *Stigmina*, *Tomenticola*, *Torula*, *Trichothecium*, *Vermiculariopsiella*, *Verticillium*, *Chaetomella*, *Colletotrichum*, *Phoma*, *Pestalotiopsis*, *Septoria*, *Uredo*, *Asterina*, *Botryosphaeria* and *Parodiella*.

Following 19 genera are represented by more than one species. The number is given in parentheses. *Alternaria*(2), *Bahusutrabeeja*(2), *Cercospora*(30), *Cladosporium*(2), *Corynespora*(13), *Curvularia*(2), *Fusarium*(3), *Passalora*(4), *Periconiella* (5), *Pithomyces*(2)

Pseudocercospora (33), *Pseudocercosporella* (2), *Spiropes* (6), *Sporidesmium* (3), *Stenella* (5), *Zygosporium* (2), *Polychaeton* (2), *Meliola* (2) and *Phyllachora* (2).

In view of regular occurrence on their host, foliicolous fungi belonging to following genera are considered as 'common', in the present study: *Acroconidiellina*, *Cercospora*, *Cladosporium*, *Cordana*, *Corynespora*, *Denticularia*, *Gonatophragmium*, *Isaria*, *Mycovellosiella*, *Passalora*, *Pseudocercospora*, *Pseudocercosporella*, *Pseudophaeoramularia*, *Pyricularia*, *Stenella*, *Stigmina*, *Polychaeton*, *Meliola* and *Phyllachora*. For example, *Areca catechu* is an irrigated perennial plantation crop grown along the west-coast of Goa and Karnataka. In the course of this study, *Acroconidiellina arecae*, an associative foliicolous fungus on *Areca catechu* was encountered in every plantation that has been visited. Green and senescent leaves exhibited conspicuous epiphyllous patches of the fungus on most leaves in almost all seasons. Similarly *Mycovellosiella eupatorii-odoratii* was a regular amphigenous foliicolous fungus observed on *Eupatorium* leaves everywhere. One more example of commonness could be *Pseudocercospora abelmoschii* on *Abelmoschus esculantus*.

In this study, genera such as *Acremonium*, *Alternaria*, *Beltraniella*, *Cladosporium*, *Cordana*, *Corynespora*, *Deightoniella*, *Denticularia*, *Fusarium*, *Janetia*, *Periconiella*, *Pithomyces*, *Pseudospiropes*, *Pyricularia*, *Pyriculariopsis*, *Sirosporium*, *Spiralum*, *Spiropes*, *Tomenticola* and *Vermiculariopsiella*, reported earlier both as litter and foliicolous (Ellis, 1971, 1976), were regularly encountered.

Hitherto workers of have qualified the foliicolous fungi as those occurring regularly on fresh leaf surface (Braun & Melnik, 1997; Goh & Heish, 1997). However, during the course of this study, besides the true foliicolous fungi, several litter mycota were also encountered on fresh living leaves for the first time. These

included *Alternaria tenuissima*, *Ardhachandra selenoides*, *Beltrania rhombica*, *Beltraniella portoricensis*, *Ceratosporella deviata*, *Corynespora elaeidicola*, *Curvularia ovoidea*, *Curvularia trifolii*, *Cylindrocladium* sp., *Dactylella ellipsospora*, *Diplococcium spicatum*, *Doratomyces nanus*, *Drechslera cynodontis*, *Excipularia narsapurensis*, *Fusarium heterosporum*, *Fusarium sambucinum*, *Hansfordia pulvinata*, *Hermatomyces tucumanensis*, *Isaria* sp., *Janetia* sp., *Kramasamuha sibika*, *Menisporopsis theobromae*, *Monodictys* sp., *Nigrospora sphaerica*, *Pseudospiropes* sp., *Sarcinella* sp., *Sporidesmium adscendens*, *S.coronatum*, *Stachybotrys kampalensis*, *Torula herbarum*, *Trichothecium* sp., *Vermiculariopsiella elegans*, *Verticillium* sp., *Zygosporium masonii* and *Z. oscheoides*, on their respective hosts. If species of *Beltrania* are to be considered as a case, it can be declared that this study is the first report of *B. rhombica* growing as foliicolous form on fresh green leaves.

A number of foliicolous fungi described in this thesis are new records to Western Ghats. These include: *Corynespora calicioidea*, *Corynespora cucurbitaecola*, *Corynespora nana*, *Deightoniella torulosa*, *Denticularia modesta*, *Gonatophragmium mori*, *Spiropes capensis*, *Spiropes clavatus*, *Spiropes guareicola* and *Spiropes helleri*.

The significant contribution in this study is the discovery of a new genus and 11 new species. These included the following: *Ceeveesubramaniomyces* gen. nov., *Acrophialophora indica* sp. nov., *Ceeveesubramaniomyces litseai* gen. et sp. nov., *Cercospora mackenziei* sp. nov., *Chaetopsina indica* sp. nov., *Chalara indica* sp. nov., *Cladosporium caryotii* sp. nov., *Cladosporium semicarpie* sp. nov., *Corynespora ghatensis* sp. nov., *Corynespora yanensis* sp. nov., *Gonatobotryum epiphyticum* sp. nov., and *Phoma ziziphii* sp. nov. The novelty of these taxa has been

justified with adequate description of the forms and comparison with earlier described similar fungi. Holotypes were maintained for all new taxa.

As said in the review, very few of foliicolous fungi have been described earlier from the Western Ghats of Goa and Karnataka. This is the first comprehensive work on floristics of foliicolous fungi from this part of the country. Besides collection and documentation of the fungi, several of them were brought into culture.

Foliicolous fungi have been worked out in several parts of the world. Baring a few (Matsushima, 1971, 1975.) there are hardly any effort of foliicolous fungi being brought into culture. During the course of this study, 50 fungi were successfully brought into pure culture by single spore or tissue-planting isolation methods. Although some of the Cercosporae were isolated and maintained in repositories in different parts of the world earlier (Samson et al., 1996), this is the first effort of foliicolous fungi being brought into culture in large number in our Country. All the cultures are maintained in growing condition in agar slants in the GUFCC.

Effort has been made to culture every foliicolous fungus encountered on host leaves and brought to the laboratory. An interesting observation was made during the course. Incidentally, mycelium grew from each inoculated single spores or from infected leaf tissues, every time. However, when the subcultured isolates were incubated further, only a few were found to survive for a longer duration of time.

Of the 202 foliicolous fungi described, initially 89 were brought into culture. In subsequent sub-culturing, several of them did not grow. A number of cultured isolates perished during the course of this work. At this stage, only 50 isolates remain viable. From this exercise, it may be inferred that, unlike the ubiquitous litter fungi, most foliicolous fungi do not survive in culture for long. This situation also gives an impression that foliicolous fungi in general, may be weak in their ability to survive in

culture. Contrary to this litter fungi are able to grow in culture for prolonged duration even if not subcultured for long time. It will be an interesting area of future research to investigate the behaviour of foliicolous fungi under culture conditions. It was also observed that the conidia of foliicolous fungi did not germinate easily in malt extract medium but grew well in medium supplemented with leaf extracts of particular host plant.

Host specificity of foliicolous fungi

During the course of this study, to ascertain the extent of host specificity of foliicolous fungi, particular fungi were collected from the same host from different localities. It was presumed that if the same fungus with similar symptoms was recorded from different places, in the range of 30 or more, the fungus might be specific to the host plant. The results showed that the particular fungus was able to infect the same plant in distantly located areas, indicating that foliicolous fungi infect mostly its associative hosts. For example, *Mycovellosiella eupatorii-odoratii* was isolated from *Chromolaena odoratum* (earlier known as *Eupatorium odoratum*), from 6 different places, during different collection trips, indicating that *M. eupatorii-odoratii* can grow mostly on *Chromolaena*. Likewise *Pseudocercospora careyae* was isolated from 5 different places only from *Careya arborea*.

As said elsewhere, ideal method of confirming host specificity should have been employment of Koch's Postulates (Rangaswamy & Mahadevan, 1999). Since the main focus of the work was studies on floristics of foliicolous fungi, only repeated occurrence of host-fungus association at different localities was documented and assessed.

Assaying the cultures of foliicolous fungi for enzyme activity:

Fifty species of the foliicolous fungi isolated from different dicot and monocot host plants were screened for their ability of producing 3 degradative enzymes, cellulase, lipase and pectinase. The results showed that 34% of the species exhibited capability to elaborate all 3 enzymes. In all, 100% were positive for lipase, 62% for cellulase, and 50% for pectinase. It was also evident that a few of the fungi were producing exclusively a particular enzyme.

All the isolates tested showed presence of lipase activity indicating their ability to degrade cuticular wax leading to superficial leaf infection. *Acroconidiellina arecae* is a good example that exhibited only lipase activity. Species of *Pseudocercospora* which were found to grow superficially on the leaf surface did not show cellulase and pectinase activity, but were only lipase positive. It was observed that most of the common foliicolous fungi did not produce pectinase, which is not required for the fungus to subsist on leaf surface. Species of *Cercospora*, which degrade the host tissue and cause conspicuous leaf spots exhibited the ability to produce cellulase and lipase.

Most of the litter fungi, isolated as foliicolous, showed their ability to elaborate all the 3 enzymes. This indicates that they are members of true decomposer community in nature. From their presence on leaf surface, it may be deduced that foliicolous nature is an extension of their activity in the ecological set up.

Epilogue

Foliicolous fungi have been described from all over the world and a wide variety of vegetations. While majority of these grow on fresh living leaves, inflicting varied kinds of leaf spot symptoms, several fungi extend their stay and subsist on

fallen, dead, plant litter. The potential of foliicolous fungi is not known much, from application point of view; however, they constitute a fairly big group of micro-fungi belonging to Hyphomycetes, Coelomycetes and Ascomycetes.

Foliicolous fungi are moderately well documented from some parts of India, especially north-eastern regions (Kamal et al., 1989; Jamaludin et al., 2004; Rao et al., 2003; Vasadeva, 1963). In southern India, except that of Hosagaouder et al. (1997), there is no other comprehensive report on these fascinating fungi.

In the absence of any detailed floristics and documentation of foliicolous fungi from this part of the country, especially the Western Ghats forests, an effort was made to study the taxonomic diversity, host specificity and ability of these fungi to secrete some of the degradative enzymes. Systematic and extensive collections were made all over Goa and neighbouring regions of Maharashtra and Karnataka during 2003-2005. A sufficiently large number of foliicolous fungi have been isolated and several of them were brought into pure culture from their leaf hosts. These cultures are deposited in 'Goa University Fungus Culture Collection', a facility established to conserve rare, interesting, unique and useful fungi of the region in live form and make them available for utilization. The foliicolous fungi isolated and described in this work are thus a addition not only to our knowledge but also wealth of the nation.

Foliicolous fungi recovered from their hosts were described in detail, in this thesis. Several new taxa of fungi have been established. The analysis of host-fungus association based on repeated occurrence of the latter on same plant at different regions revealed that there could be some degree of host-specificity expressed by these fungi. As understood from this work, the foliicolous fungi are also armoured with useful enzymes, which may have application value, besides their infective ability.

Sufficiently large collection of specimens, documentation and descriptions of a number of novel taxa of foliicolous fungi from the Western Ghats, indicate that we have incredible fungi in our area. Floristic details and biological associations when investigated systematically, as done in this study, a treasure of information gets unfolded before us. It is something like nature revealing secrets before us. For an ardent student of mycology, this is a joyful experience. This is a modest contribution to the understanding and conservation of our national bioresources.

CHAPTER V

SUMMARY

In the present study, foliicolous fungi occurring on fresh leaves of angiosperm plant species have been collected and studied in detail from 42 localities from the State of Goa and adjoining areas of Karnataka and Maharashtra. The localities have been visited once or more, during the study period. In all, 202 taxa of foliicolous fungi were assignable to 78 genera isolated from 1725 samples gathered. Fifty fungi were brought into culture.

Diverse habitats such as grassland plateaus, deciduous and semi-deciduous forests, evergreen sholas, scrub jungles and cultivated plantations all across the State of Goa and adjoining regions have been visited for collection of fungal samples. Observation of fresh infected leaf samples directly under the microscope and subsequent to moist chamber incubation were the two methods employed for isolation of fungi.

The fungi obtained included Hyphomycetes (166 species in 66 genera), Coelomycetes (8 species in 7 genera), Ascomycetes (7 species in 5 genera) and undetermined forms [(Hyphomycetes (11), Coelomycetes (4) and Ascomycetes (6)]. Hyphomycetes were the largest group encountered.

Diagnostic characters of microfungi such as morphology, colour and size of the colony and sporulating structures, such as ascomata, asci and ascospores in case of Ascomycotina and conidiomata, conidiophores and conidia in case of Deuteromycotina, formed the basis for identification. Detailed description along with information of specimens examined has been given for each species in the text, along with camera lucida illustrations and photomicrographs wherever possible.

The species and genera were fully described based on definite specimen, material or culture of the fungus. Representative herbarium specimens and pure cultures were maintained in the Herbarium of Botany Department, Goa University

(GUBH) and .Goa University Fungus Culture Collection (GUFCC) respectively. Of the novel forms, at this stage, only the names are latinised in the text and the novelty of these presently remains only provisional. Appropriate references were consulted at every step to analyse and confirm the floristic data obtained on foliicolous fungi of the region under study.

A total of 78 genera of fungi were documented in this study. Of these, the 59 were represented by single species. Another 19 genera were represented by species more than one (2-33). Foliicolous species belonging to 19 genera were recognized as 'common' forms. Species of 20 genera, reported earlier both as litter and foliicolous were regularly encountered in this study. Thirty-five species of litter fungi, for the first time, were encountered as foliicolous in this study. Ten species were new records to Western Ghats.

The following genus (1) and species (11) were introduced as new to science, through this study. *Ceevesubramaniomyces* gen. nov., *Acrophialophora indica* sp. nov., *Ceevesubramaniomyces litseai* gen. et sp. nov., *Cercospora mackenziei* sp. nov., *Chaetopsina indica* sp. nov., *Chalara indica* sp. nov., *Cladosporium caryotii* sp. nov., *Cladosporium semicarpie* sp. nov., *Corynespora ghatensis* sp. nov., *Corynespora yanensis* sp. nov., *Gonatobotryum epiphyticum* sp. nov., and *Phoma ziziphii* sp. nov. The novelty of these taxa has been justified with adequate description of the forms and comparison with earlier described similar fungi. Holotypes were maintained for all new taxa.

During the course of this study, 50 foliicolous fungi were successfully brought into pure culture by single spore or tissue-plating isolation methods. All of these were maintained in growing condition in agar slants in the GUFCC. Unlike the ubiquitous litter fungi, most of the foliicolous fungi did not survive in culture for long.

An unconventional method was followed to elucidate the host specificity of foliicolous fungi. The results showed that most foliicolous fungi exhibit some degree of specificity to its associative hosts.

Fifty species of the foliicolous fungi brought into culture were screened for their ability to produce cellulase, lipase and pectinase. The results showed that 34% of the species exhibited ability to elaborate all 3 enzymes. In all, 100% were positive for lipase, 62% for cellulase, and 50% for pectinase. It was also evident that a few of the fungi were producing exclusively a particular enzyme. From their presence on leaf surface, it may however be deduced that foliicolous nature is an extension of their activity in the ecological set up.

Foliicolous fungi have been described from all over the world and a wide variety of vegetation. While majority of these grow on fresh living leaves, inflicting varied kinds of leaf spot symptoms, several fungi extend their stay and subsist on fallen, dead, plant litter. They now constitute a fairly big group of micro-fungi belonging to Hyphomycetes, Coelomycetes and Ascomycetes. The potential of foliicolous fungi however is not known much.

Foliicolous fungi have been fairly well documented from some parts of India, especially north-eastern regions. Except a few stray reports there has been no detailed document on these fungi, from southern India. The present work now stands as an authentic report of foliicolous fungi from the Goa and adjoining regions of Karnataka and Maharashtra. Effort was made to study the taxonomic diversity, host specificity and ability of these fungi to secrete some of the degradative enzymes. The foliicolous fungi isolated and described in this work are thus an addition not only to our knowledge but also wealth of the nation.

Sufficiently large collection of specimens, documentation and descriptions of a number of novel taxa of foliicolous fungi from the Western Ghats, indicate that we have incredible fungi in our localities. Floristic details and biological associations when investigated systematically, as done in this study, a treasure of information gets unfolded. This is a modest contribution to the understanding and conservation of our national bioresources.

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APPENDIX

LIST OF PUBLICATIONS:

1. Pratibha, J., Hyde, K.D. and D.J. Bhat. 2004. *Ceeveesubramaniomyces*, a new dematiaceous hyphomycetous genus from India. *Kavaka*, 32: 21-26.
2. Pratibha, S.J., Gawas, P. Shenoy, B.D., Hyde, K.D. and Bhat, D.J. 2005. *Chalara indica* sp. nov. and *Sorocybe indicus* sp. nov. from India. *Cryptogamie Mycologie* 26(2): 97-103.
3. Pratibha, J. and D.J. Bhat. 2006. *Bahusutrabeeja manoharacharii* sp. nov., a foliicolous hyphomycete from the forests of Western Ghats, India. In: *Emerging trends in mycology plant pathology and microbial biotechnology*. (Eds. Bagyanarayana, G., Bhadrachari, B. and Kunwar, I.K.) BS Publications, Hyderabad.

Ceeveesubramaniomyces, a new dematiaceous hyphomycetous genus from India

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ABSTRACT

Ceeveesubramaniomyces litseai gen. et sp. nov., characterized by mononematous conidiophores with a sharply curved, dark brown, hook-like, branch in the middle and ampuliform, monophialidic conidiogenous cells arranged solitary or in verticils above the base, has been isolated from circular, tiny leaf spots found on mature leaves of *Litsea* sp. (Lauraceae) from moist deciduous forests of Yana, Uttara Kannada, Karnataka, India. The novel genus is described and illustrated, and compared with morphologically similar genera such as *Cryptophiale*, *Kionochaeta* and *Zanclospora*.

INTRODUCTION

We deem it a privilege to dedicate this paper in honour of Professor C.V. Subramanian, a doyen of Indian Mycology and former Director of Centre of Advanced Studies in Botany, University of Madras, Chennai on the occasion of his 80th birthday.

During the course of studies on biodiversity of follicolus fungi from forests of Western Ghats, South India, we encountered a novel hyphomycete impacting circular, tiny, leaf spots on mature living leaves of *Litsea* sp. (Lauraceae) in Yana, near Ankola, Uttara Kannada, Karnataka State, India. The fungus is described and illustrated in this paper.

MATERIAL AND METHODS

Leaves of *Litsea* with circular, tiny, grayish brown spots were collected and brought to the laboratory in zip-seal polytene bags. Fungal material from the leaf spot was carefully scrapped with a fine-tipped needle and mounted on a slide containing a drop of lactophenol and examined under the light microscope. The

material was air-dried and placed in labeled paper bags along with a piece of naphthalene pellet as herbarium specimen.

TAXONOMY

Ceeveesubramaniomyces Pratibha, K.D. Hyde et Bhat gen. nov. (Etym: In honour of Professor C.V. Subramanian)

Maculae amphigenae. Ad fungos hyphomycetes pertinens. Coloniae effusae, griseo-brunneae, mycelium immersum in substratum, ex hypis septatis, ramosis, hyaline vel subhyalinae, laevibus, compositum. Conidiophora macronematica, mononematica, erecta, recta vel flexuosa, septata, ramosa, pallide brunnea ad basim, subhyalina vel hyalina ad apicem, laevia, cum exigue curvata, unciforma, crassitunicata, atrobrunnea, ramosa in medio. *Cellulae conidiogena*e monophialidicae, discrete, aliquando solitariae, verticillatae, ampulliformes vellageniformes, leaves, per vel vacuus emineo collarata. Conidia endogena, hyalina, allantoidea, laevia, utrinque rotundata, aseptata, ad apicem cellularum conidiogena-rum in mass is mucosis incolaratis aggregate.

Leaf spots amphigenous. Colonies effuse, grayish brown, with mycelium internal in the substrate tissue, composed of septate, branched, hyaline to subhyaline, smooth hyphae. Conidiophores macronematous, mononematous, erect, straight to flexuous, septate, branched, pale brown at the base, subhyaline to hyaline towards the tip, smooth, with a sharply curved, hook-like, thick-walled, dark brown, branch in the middle. Conidiogenous cells monophialidic, discrete, sometimes solitary, mostly in verticils below the hook-like curved branch, ampulliform to lageniform, smooth, with or without a collarete. Conidia endogenous, hyaline, allantoid, smooth, rounded at both ends, aseptate, produced in a slimy mass at the tip of the phialide.

Type species - *Ceeveesubramaniomyces litseai* Pratibha, K.D. Hyde et Bhat.

Ceeveesubramaniomyces litseai Pratibha, K.D. Hyde et Bhat gen. et sp. nov.

(Figs 1 & 2 a-f).

Maculae amphigenae, circulares, griseae, 4-6 mm diam. Coloniae effusae, griseo-brunneae, mycelium in substratum, ex hyphis septatis, ramosis, hyalinae vel subhyalinae, laevibus, 2-4.5 μ m latis compositum. Conidiophora macronematica, mononematica, erecta, recta vel flexuosa, septata, ramosa, pallide brunnea and basim, subhyalina vel hyalina and apicem, laevia, 100 - 170 μ m \times 3.5 - 5 μ m, septata, cum exigue curvata, unciforma, crassitunicata, atrobrunnea, ramosa in medio. *Cellulae conidiogenae* monophialidicae, discrete, aliquando solitariae supremas, verticillatae, inferus unciformae; ampulliformae, laeviae, pallide brunneae, panudis inside, 6 - 8.5 \times 2.0 - 3.5 μ m superne unciformae hyalinae, laeviae, lageniformes, 6 - 17.5 \times 2.5 - 5 μ m, per vel vacuus emineo collaratae. Conidina endogena, hyalina, allantoida, laevia, utrinque rotundata, aseptata, 5 - 7.5 \times 2 - 3 μ m, and apicem

cellularum conidiogenarum in masis mucosis incolaratis aggregate.

Leaf spots amphigenous, circular, greyish, 4-6 mm diam. epiphyllous, later spreading over the entire leaf surface. Fungus hyphomycete. Colonies effuse, grayish brown, with mycelium internally in the substrate tissue, composed of septate, branched, hyaline to subhyaline, smooth, 2 - 4.5 μ m wide hyphae. *Conidiophores* macronematous, mononematous, erect, straight to flexuous, septate, branched 1-2 times, pale brown at the base, subhyaline to hyaline towards the tip, smooth, 100 - 170 μ m long, 3.5 - 5 μ m wide at the broadest region, septate, with a sharply curved, hook-like, thick-walled, dark brown, branch at midway from the base. *Conidiogenous cells* monophialidic, discrete, sometimes solitary above, mostly in verticils of 4-6 below the shield-like curved branch, those in verticils, ampulliform, smooth, very pale brown, curved inward, 6.8 \times 2 - 3.5 μ m, with or without a collarete; above the hook-like branch hyaline, smooth, lageniform, 6 - 17.5 \times 2.5 - 5.0 μ m, with a conspicuous collarete. Conidia endogenous, hyaline, allantoid, smooth, rounded at ends, aseptate, 5 - 7.5 \times 2 - 3 μ m, produced in a slimy mass at the tip of the phialide - Teleomorph - unknown.

HOLOTYPE: On leaves of *Litsea* sp. (Lauraceae), Pratibha J., 21 January, 2005, Yana, Uttara Kannada, Karnataka, India, Herb. No. GUBH P 198

DISCUSSION

Genera such as *Cryptophiale* Pirozynski, *Kionochaeta* Kirk and Sutton and *Zancluspora* Hughes and Kendrick producing phialoconidia on mononematous, erect, setiform to mycelial, dark to medium brown, conidiophores with ampulliform to lageniform conidiogenous cells show some similarity with *Ceeveesubramaniomyces*

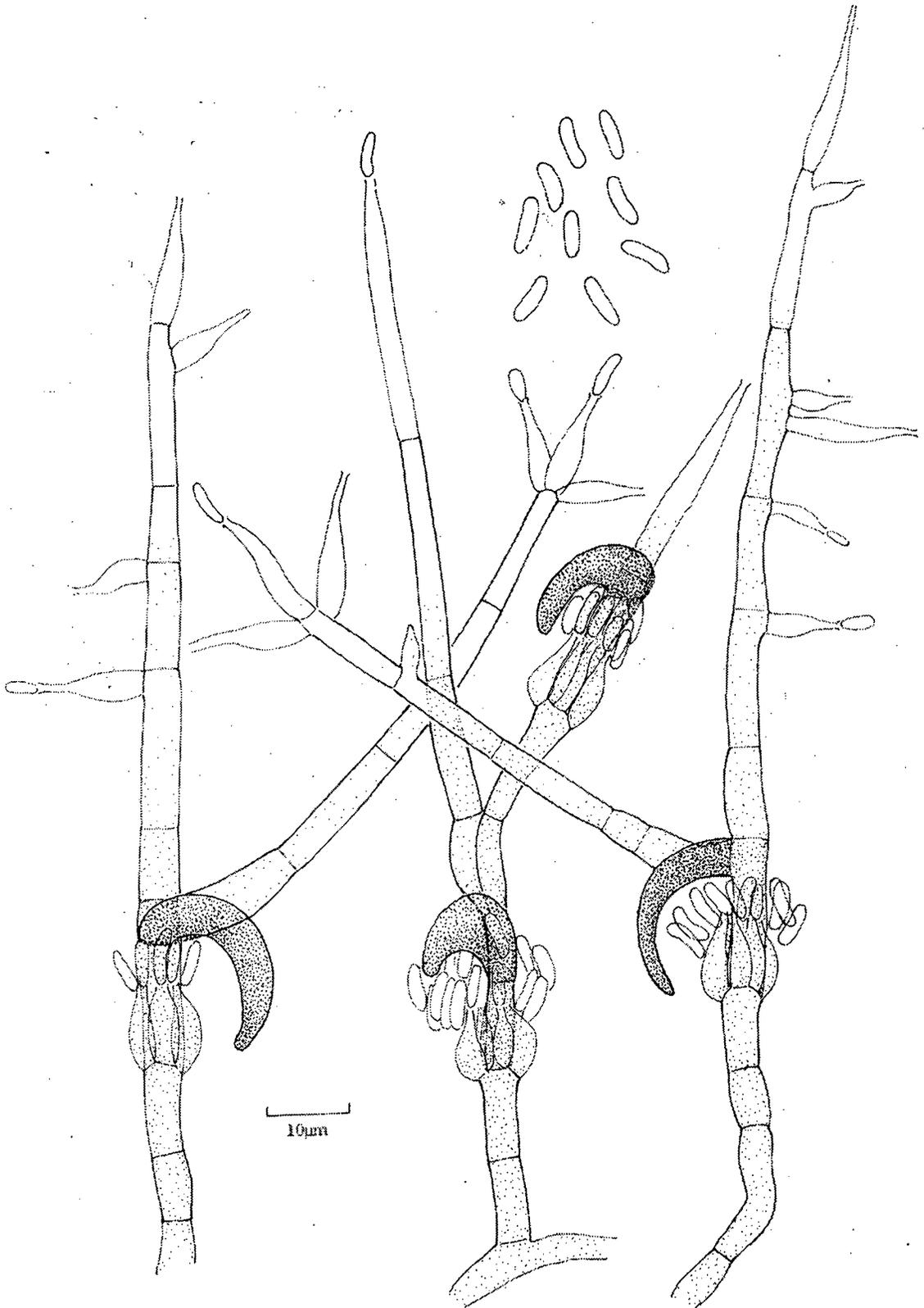


Fig. 1 *Ceeveesubramaniomyces litseai*
 a, b and c-conidiophore with hook like curved branch and verticillate of phialides.
 Upper part contain solitary phialides. d - conidia

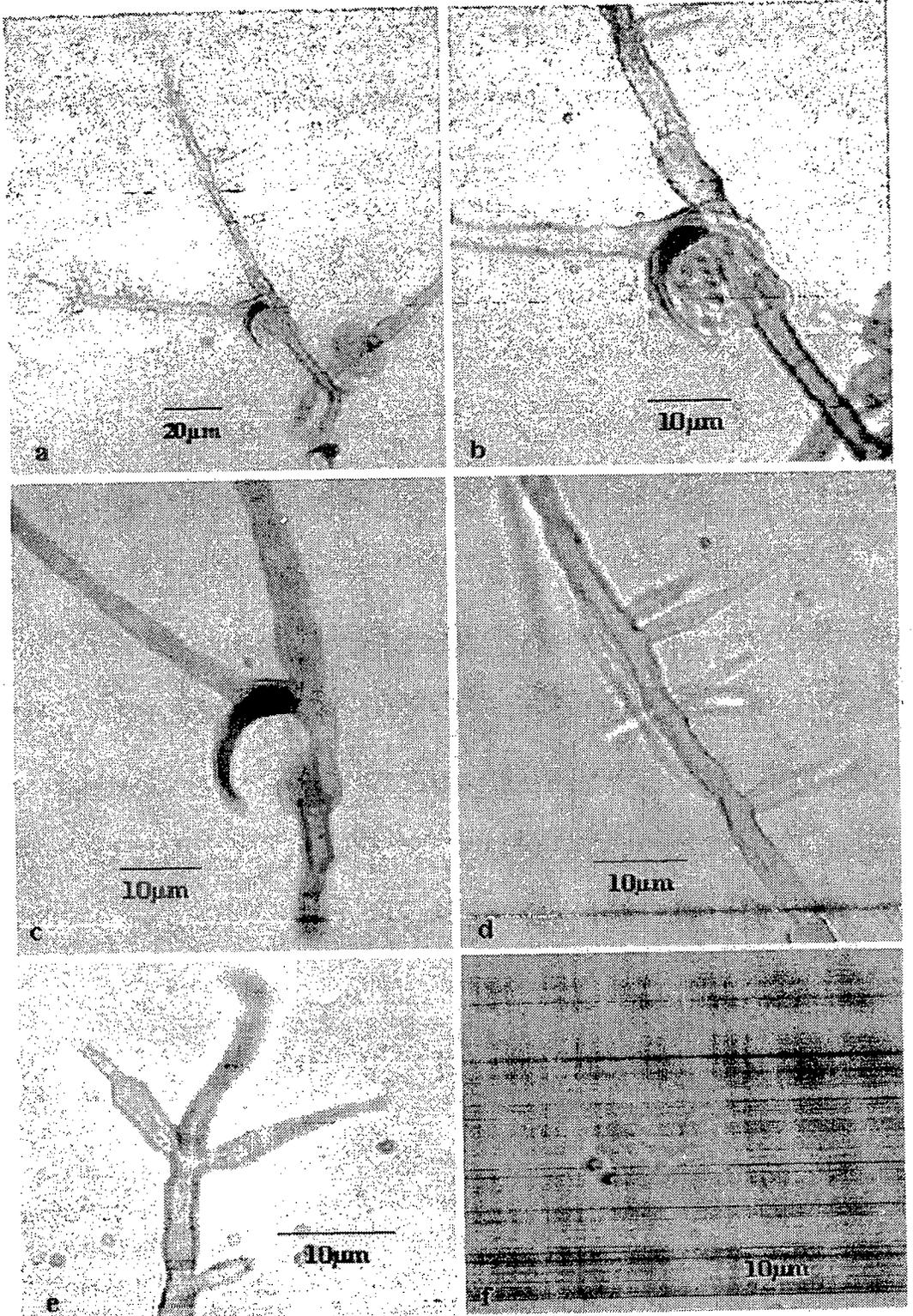


Fig. 2 *Ceevesubramaniomyces litseai*
 a-conidiophore with hook like branch and verticle of phialides.
 b-verticle of phialides with conidia; c-hook like curved branch; d&e-solitary phialides;
 f-conidia

(Ellis, 1971; Carmicheal *et al.*, 1980; Hawksworth *et al.*, 1995). In *Cryptophiale*, typified by *C. kakombensis* Pirozynski, the row of phialides on the fertile zone of setiform conidiophore is covered by a palisade of sterile, shield-like tissue (Pirozynski 1968; Bhat and Kendrick 1993). In *Kionochaeta*, typified by *K. ramifera* (Matsushima) Kirk and Sutton (Kirk and Sutton, 1985), the setiform, branched, conidiophores are fertile mostly in the central part with penicillately arranged bunches of phialides. In *Zanclospora*, typified by *Z. novae-zelandiae* Hughes and Kendrick the conidiophores bear verticils of sessile phialides in the central 3-4 septa (Hughes and Kendrick, 1965). In none of these, however, the hook-like, curved, dark-coloured, stiff branch developing from the septa above the whorl of conidiogenous cells is present, as in *Ceeveesubramaniomyces*.

ACKNOWLEDGEMENTS

P.J. and D.J.B thank the University Grants Commission, Council of Scientific and Industrial Research and Ministry of Environment & Forests, Government of India, New Delhi, for financial support in the form of research grants during the tenure

of which this work carried out. We thank Dr. W. Gams, Netherlands, for helpful suggestions in improving the paper.

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***Chalara indica* sp. nov. and *Sorocybe indicus* sp. nov. from India**

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Abstract – Two new hyphomycetes, *Chalara indica* and *Sorocybe indicus*, collected from the forests of Western Ghats in Goa, India, are illustrated and described in this paper. *Chalara indica* sp. nov., based on a fungus isolated from fresh leaves of *Areca catechu* (Arecaceae), is characterized by fasciculate, mononematous conidiophores with percurrently regenerating phialidic conidiogenous cells and cylindrical conidia which are rounded at the tip and truncate at the base. *Sorocybe indicus* sp. nov., characterized by white, terminally olivaceous to median brown synnemata and hyaline, fusiform conidia developing in branched, acropetal chains on holoblastic conidiogenous cells, was isolated from hanging, dead twigs of *Anacardium occidentale* (Anacardiaceae).

Anamorphic fungi / biodiversity / taxonomy / tropical fungi

INTRODUCTION

During the course of an on-going study of fungi of the Western Ghats in southern India, we encountered two new fungal species. One, a species of *Chalara* (Corda) Rabenh., was present on leaf spots on fresh and intact leaves of *Areca catechu* (Arecaceae) in a plantation. The second, a synnematous fungus of the genus *Sorocybe* Fr., was found on dead, hanging twigs of *Anacardium occidentale* (Anacardiaceae) about 2 m above the ground level. The fungi were compared with previously described similar taxa in respective genera and found to be distinct and warrant taxonomic disposition as two new species.

Attempts to culture the fungi were partially successful. The synnematous fungus was recovered in culture by single spore isolation method. The sample, slide and culture are deposited at the Goa University Fungus Culture Collection. The fungi are described and illustrated below.

TAXONOMY

Chalara indica Pratibha, K.D. Hyde et Bhat, sp. nov.

(Figs 1-2)

Leaf spots amphigenae, sphaericae vel infra-sphaericae, brunneae, 0.7-2 cm diam. Coloniae effusae, brunneae, mycelium immersum, ex hyphis ramosis, septatis,

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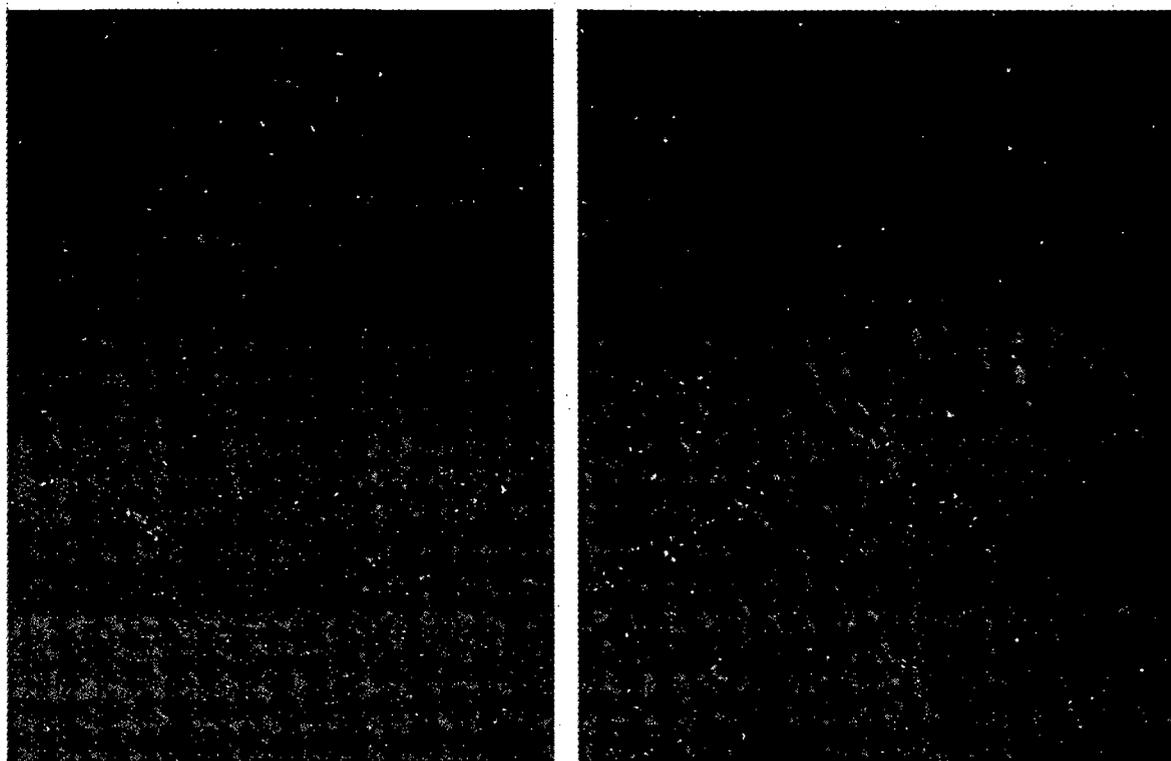


Fig 1, a and b: *Chalara indica*: conidiophores and conidia.

2-3 μm *latis compositum*. *Conidiophora fasciculata, mononematosa, brunnea, 1-3-septata, non-ramosa, laevia, 70-170 \times 6-10 μm . Cellulae conidiogenae monophialidicae, regenerance purcurrentibus, palescentiorae vel brunneae, laeviae, 55-70.5 μm longae; venter rotundatae vel sub-cylindrica, 32.5-40 μm longae, 11-16.5 μm latae; collarete cylindrica, 25-32.5 \times 8-10 μm . Conidia mucosa, endogena, hyalina, cylindrica, laevia, eseptata, apice rotundata, basi truncata, 20-30 \times 5-6.5 μm , in basipetale pseudo-catenis facile.*

Holotypus on leaves of *Areca catechu* Linn. (Arecaceae), J. Pratibha, 12 July 2003, Kesarval, Goa, India, Herb. GUFC No. P49.

Paratypus: from the same origin, HKU(M) 17495.

Leaf spots amphigenous, circular to sub-circular, brown, 0.7-2 cm in diam. *Colonies* effuse, brown, composed of immersed mycelium with branched, septate, 2-3 μm wide hyphae. *Conidiophores* fasciculate, mononematous, brown, 1-3-septate, unbranched, smooth, 70-170 \times 6-10 μm . *Conidiogenous cells* phialidic, purcurrently regenerating, pale to moderately brown, smooth, 55-70.5 μm long; *venter* round to sub-cylindrical, 32.5-40 μm long, 11-16.5 μm wide at the broadest part; *collarete* cylindrical, 25-32.5 \times 8-10 μm . *Conidia* slimy, endogenous, hyaline, cylindrical, smooth, aseptate, rounded at apex, truncate at the base, 20-30 \times 5-6.5 μm , developing in basipetal chains.

Notes. The genus *Chalara*, typified by *C. fuscidioides* (Corda) Rabenh., is characterized by sessile or stalked, loose to fasciculate, unbranched to rarely branched, mononematous, light to moderately brown conidiophores, phialidic conidiogenous cells with a basal venter, a long collarete and a deep-seated conidiogenous locus, and hyaline, usually cylindrical, 1-2-celled, conidia which are sometimes in slimy, short to long chains. Nag Raj and Kendrick (1975) monogra-

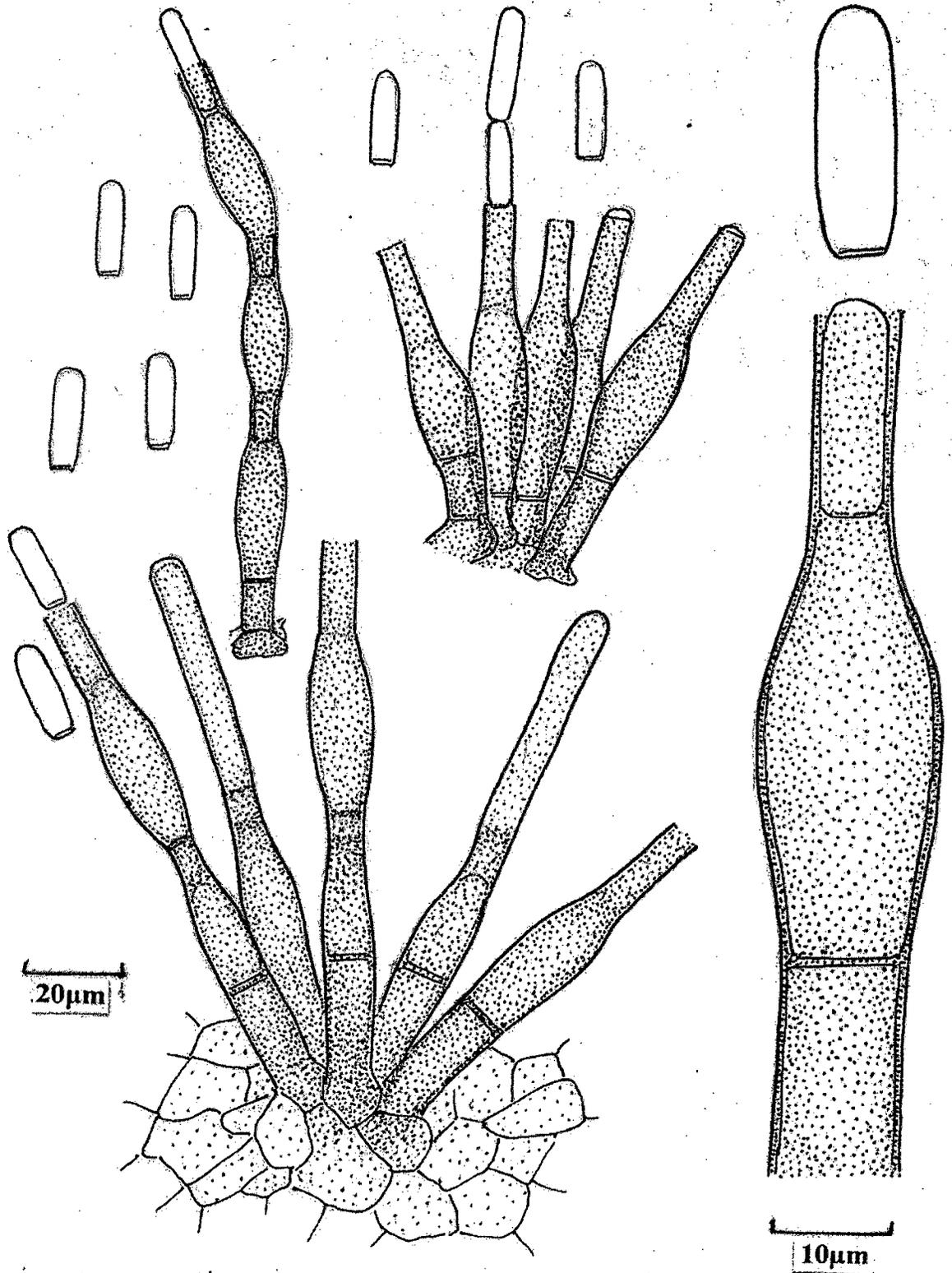


Fig. 2: *Chalara indica*: conidiophores and conidia.

phed *Chalara* and provided a key to the accepted species. McKenzie *et al.* (2002) while describing two new species provided a key to the taxa described since 1975 in the genus.

Of the nearly 100 so far known species in the genus, *C. indica* may be compared with *C. microchona* W. Gams (Gams and Holubova-Jechova, 1976) for its regenerating phialides and *C. sibika* Subram. and Sudha (Subramanian and Sudha, 1986) in conidial dimensions. However, in *C. microchona* the phialides regenerate sympodially and the conidia are $3.5-5 \times 1.3-2.5 \mu\text{m}$. In *C. sibika*, the cylindrical conidia are truncate at both ends and measure $12.1-26.4 \times 2.5-3.3 \mu\text{m}$. Further, the first-formed conidia in *C. sibika* are turbinate ($6.5-9.5 \times 4.8-6$), whereas the conidia in *C. indica* are undifferentiated.

Sorocybe indicus Puja, K.D. Hyde et Bhat, sp. nov. (Figs 3-4)

Coloniae effusae, canities, capillatus. Mycelium immersum. Conidiophora synnematosae, erectae, ordino confertim, laevia, septata, synnema $500-700 \times 35-85 \mu\text{m}$. Cellulae conidiogenae in conidiophoris incorporatae, holoblasticae, polyblasticae, determinatae, hyalinae vel olivaceae brunnea, laevia, $14-20 \times 1-1.5 \mu\text{m}$. Conidia catenula, limosus, fusiformes, ambo extrema planus, hyalinae vel pallide brunnea, laevia vel verruculosa, eseptate, $6-20 \times 2-5 \mu\text{m}$,

Conidial hyphomycete. Colonies effuse, white to gray, hairy. Mycelium mostly immersed, composed of 1.5 to $2 \mu\text{m}$ wide, hyaline hyphae. Conidiophores synnematosus, erect, compactly arranged, smooth, septate, branched in the above half, hyaline below the lower $3/4^{\text{th}}$, olivaceous to dark brown towards the apex; synnema $500-700 \times 35-85 \mu\text{m}$. Conidiogenous cells holoblastic, polyblastic, integrated, determinate, hyaline to pale olivaceous brown, smooth, $14-20 \times 1-1.5 \mu\text{m}$. Conidia catenate, slimy, fusiform, flat at both the ends, hyaline to very pale brown, smooth to minutely verruculose, one-celled, $6-20 \times 2-5 \mu\text{m}$, developing in branched, acropetal chains, with broad interconidial constricted septa, with remnant of the conidiogenous cell often remaining at the base; terminal conidium truncate at the base, apiculate to elongated at the tip, $6-30 \times 2-3 \mu\text{m}$.

Colonies on MEA effuse, very slow growing, white to gray, woolly, slightly raised at the center, with partially immersed mycelium, up to 1.5 cm diam in 7 days at 25°C , reverse grayish-black. The fungus in culture did not sporulate even after two months of incubation.

Holotype: Western Ghats, Goa; on hanging dead twigs of *Anacardium occidentale* Linn., 14 July 2003, Puja, G., Herb. GUFCC No. AF-11; Cultura ex-type (GUFCC, No.-3179).

Notes. In a taxonomic reassessment of the genus *Sorocybe* Fr., [Type sp. *S. resinae* (Fr.)Fr.], Partridge and Morgan-Jones (2002) considered *Pycnostysanus* Lindau and *Hormoconis* Arx & G.A. de Vries as nomenclatural synonyms of the former. The genus *Sorocybe* is characterized by mostly synnematosus, compactly arranged, brown, smooth, septate, distally branched conidiophores, polyblastic, integrated, determinate conidiogenous cells and catenate, dry, unicellular, fusiform to ellipsoidal, pale brown to brown conidia. The conidiogenous loci are protuberant and interconidial septa are distinctly wide in the wood-inhabiting, saprophytic *S. resinae*. In natural condition, both synnematosus and mononematosus forms are recognized in close proximity to one another. Besides the type, *S. tenella* is the only other known species in the genus.

Partridge & Morgan-Jones (2002) established monotypic genus *Seifertia* Partridge & Morgan-Jones, with *S. azaleae* (Peck) Partridge & Morgan-Jones as type, for the causal organism of bud blast and twig blight of azaleas and rhodo-

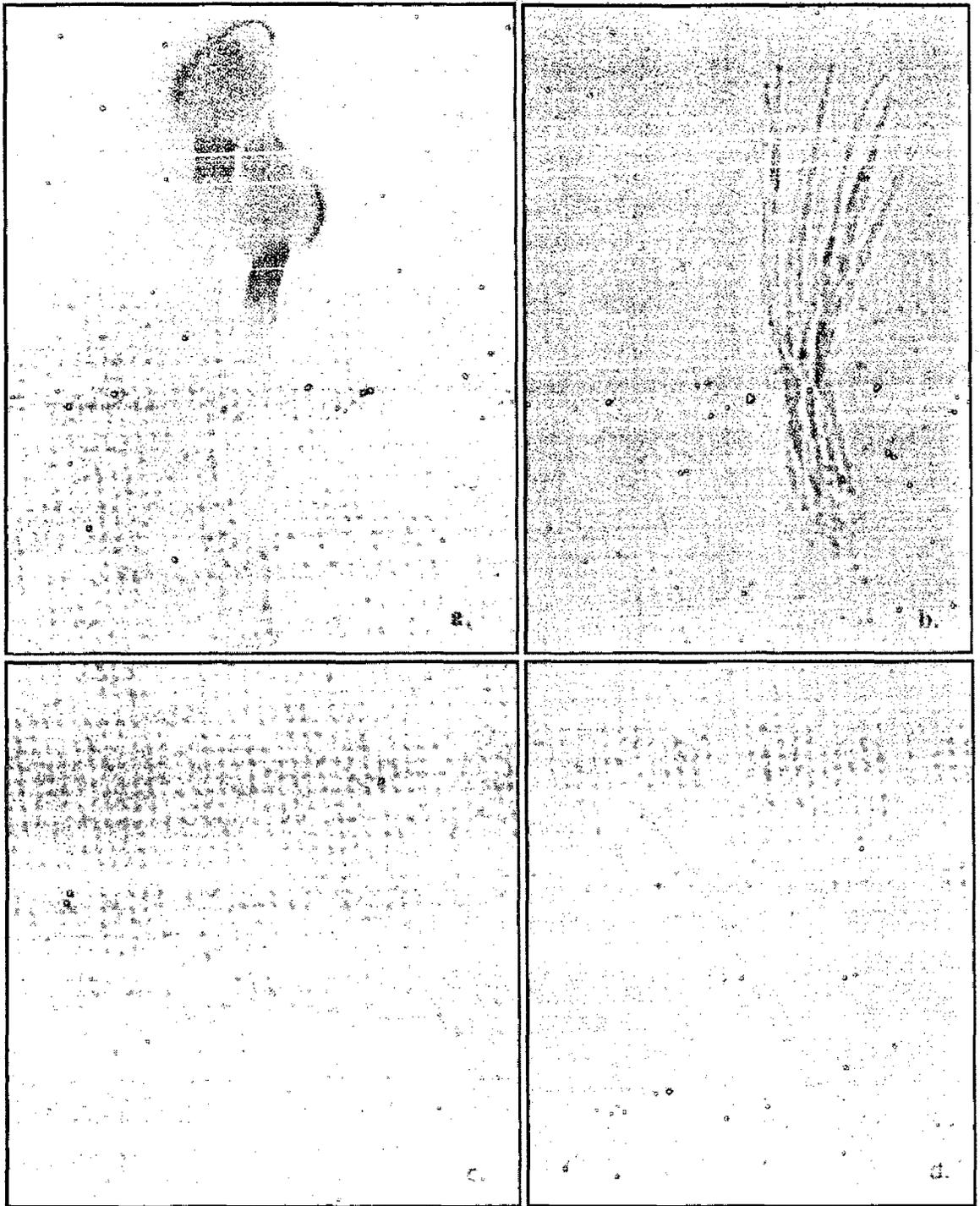


Fig. 3, a-d: *Sorocybe indicus*: synnemata and catenate conidia.

dendrons. Though, with synnematosus, brown, compactly arranged, septate, distally branched conidiophores, integrated, polyblastic conidiogenous cells and catenate, unicellular, oblong or ellipsoidal conidia, *S. azaleae* superficially resembles to *Sorocybe resiniae*, differs from the latter in its narrow interconidial isthmi and virulently plant pathogenic habitat.



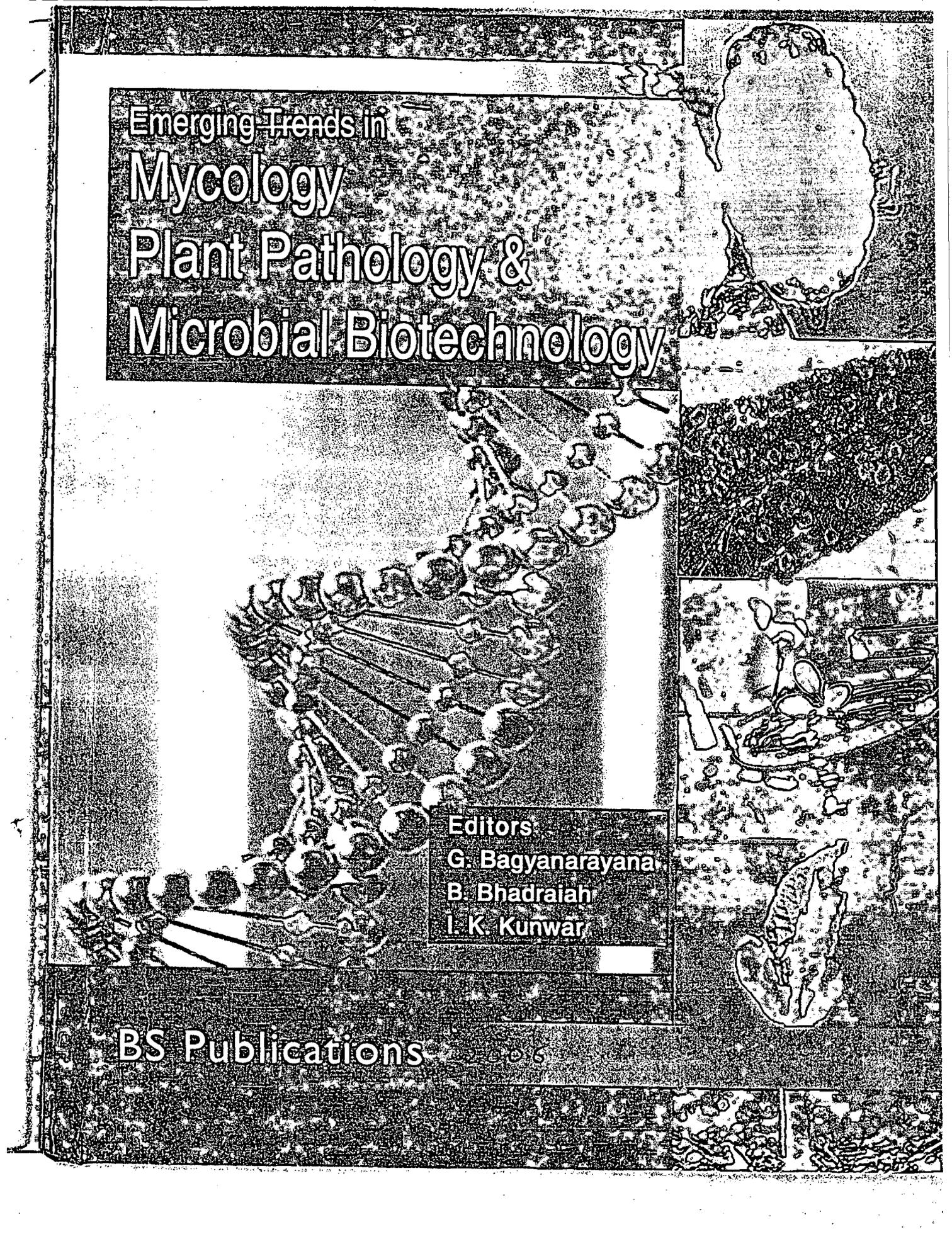
Fig. 4: *Sorocybe indicus*: Synnemata, conidiophores and catenate conidia.

With broad interconidial septa and saprotrophic habitat, *S. indicus* justifies its placement in *Sorocybe*. The fungus differs from earlier known species with hyaline but terminally olivaceous brown synnemata, and comparatively long intercalary conidia: 6-20 × 2-5 µm, terminal conidium: 6-30 × 2-3 µm; *resinae*: conidium: 5-11 × 3-6 µm), slimy, very pale brown, minutely verrucose sphaeria.

Acknowledgements. PJ, PG and DJB are indebted to the Council of Scientific & Industrial Research and the Department of Environment and Forests, Government of India, for research support grants. B.D. Shenoy thanks The University of Hong Kong for award of a Postgraduate studentship.

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The background of the cover is a collage of black and white electron micrographs. The largest image on the left shows a cross-section of plant tissue with a distinct cell wall and internal organelles. To the right, there are several smaller, more detailed images showing cellular structures, possibly related to fungal infection or plant defense mechanisms. The overall texture is grainy and high-contrast.

Emerging Trends in
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Bahusutrabeeja manoharacharii sp. nov., a Foliicolous Hyphomycete from the Forests of Western Ghats, India

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ABSTRACT

Bahusutrabeeja manoharacharii sp. nov., a foliicolous hyphomycete isolated from live leaves of *Bridelia scandens* Roxb (Euphorbiaceae) gathered from Chorla Ghat, Goa, India, is illustrated and described. In addition, hitherto described species of the genus are compared in this paper.

KEY WORDS : Biodiversity; conidial fungi; *Bahusutrabeeja manoharacharii*.

We deem it an honour to have been invited to present a paper to the Volume dedicated to Professor C. Manoharachary, Osmania University, Hyderabad, who made significant contribution to the development of mycology in India.

The hyphomycete genus *Bahusutrabeeja* Subram. & Bhat was established with *B. dwaya* Subram. & Bhat as type species (Subramanian and Bhat, 1977). The genus is characterized by mononematous, percurrently proliferating conidiophores with simple, phialidic conidiogenous cells producing setulate conidia which are usually aggregated into a slimy mass at the tip of the phialide. To date, a further four species namely, *B. angularis* Rao & de Hoog, (Vasant Rao and de Hoog, 1986), *B. globosa* Bhat & Kendrick (Bhat and Kendrick, 1993), *B. dubhashii* Bhat (Bhat, 1994) and *B. bunyensis* Mckenzie (Mckenzie, 1997) have been described in the genus.

During the course of our studies on biodiversity and taxonomy of foliicolous fungi of the Western Ghát forests, we recovered an isolate of *Bahusutrabeeja*, from live leaves of *Bridelia scandens* Roxb (Euphorbiaceae) gathered from Chorla Ghat, Goa, India, which differed markedly from all known species in the genus in its conidiophore and conidial dimensions. The fungus is disposed in a new species.

Materials and Methods

Fresh, green leaves with leaf spots gathered from the plant were placed in polythene bags and brought to the laboratory. The samples were first examined under a stereoscope to locate the fungal colony. On spotting, the fungus was lifted by a fine-tipped needle, placed on a drop of lactophenol on a clean slide and examined under a light microscope.

Taxonomic Part

Bahusutrabeeja manoharacharii Pratibha et Bhat sp. nov. (Figs. 1 & 2) (Etym., Specific epithet: in honour of Prof. C. Manoharachary, Osmania University, Hyderabad, India).

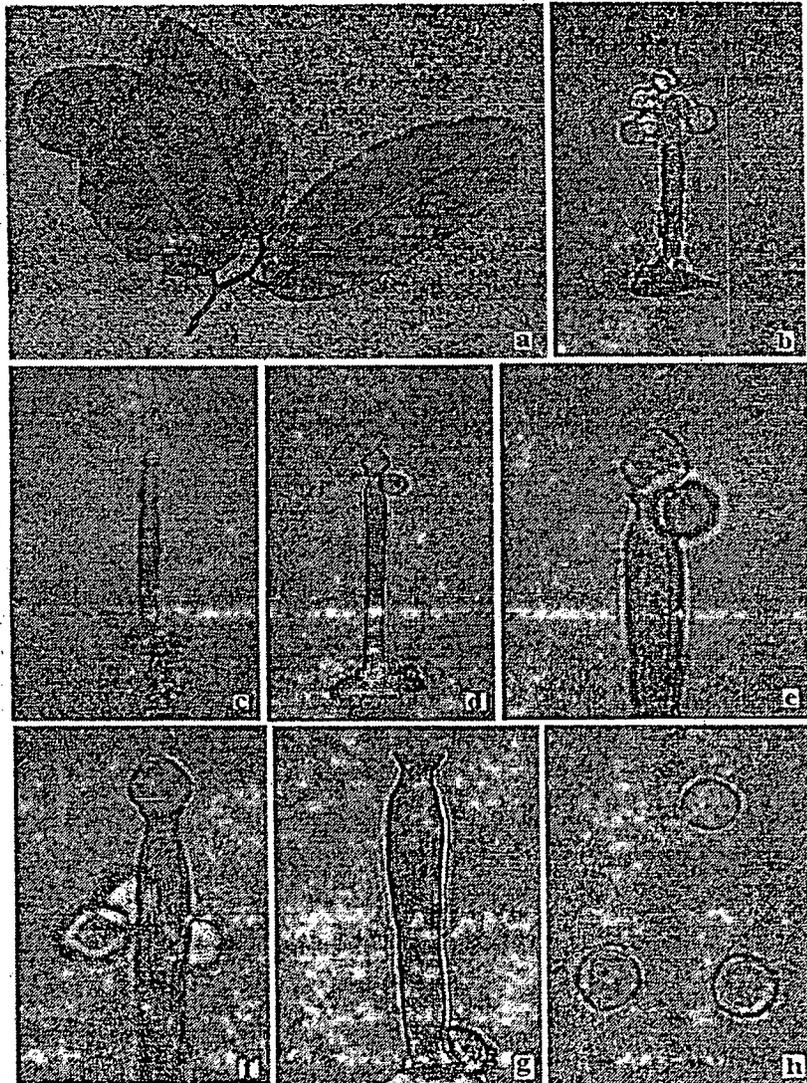


Figure 1 *B. manoharacharii*, a: leaf spots; b-f: conidiophores with conidia; g: phialide; h: conidia

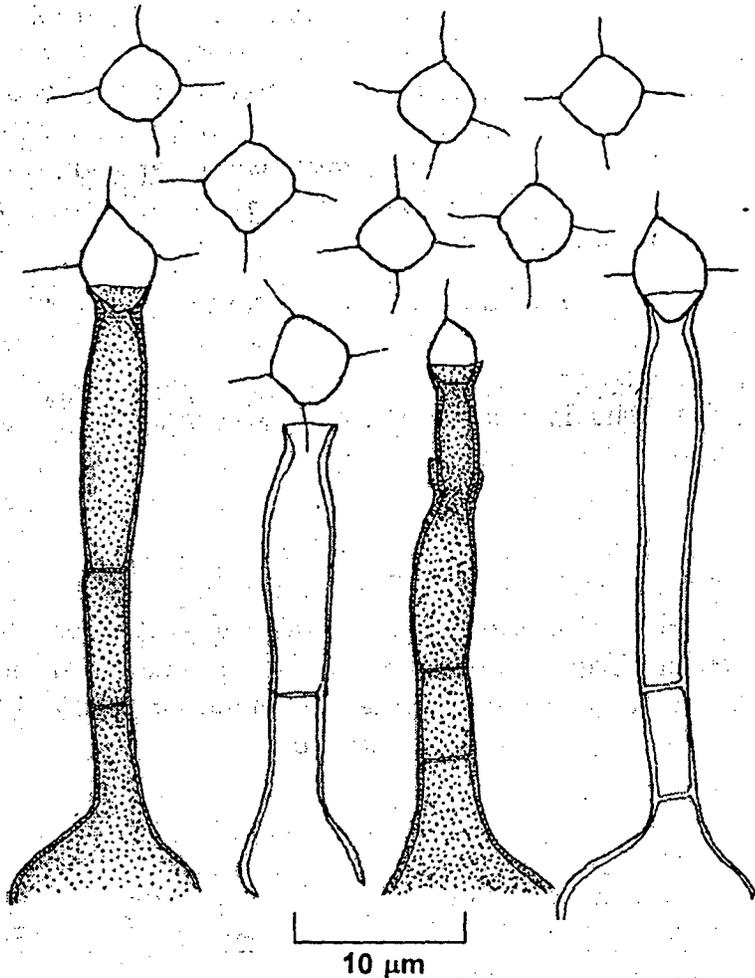


Figure 2 *B. manoharacharii*, Conidiophores and conidia

Ad fungos conidiales, hyphomycetes. *Leaf spots* amphigenae, dissitae, sphaericae, atrobrunneae, 4-6 mm dia. *Coloniae* effusae, atrobrunneae, velutinae. *Mycelium* immersum, laevis, subhyalinis, septatis, ex hyphis ramosis 2-2.5 μm lat. compositum. *Conidiophora* mononemata, erecta, recta vel flexuosa, laevia, brunnea, crassitunicata, 1-2-septata, non-ramosa, percurrenter proliferations, 40-87.5 \times 5.5-8.5 μm . *Cellulae conidiogenae* terminales, integratae, monophialidicae, subcylindricae, laeviae, 25.5-50 \times 5.8-8.5 μm , cum collarulo conspicuo. *Conidia* solitaria, hyalina, crassitunicata, angulata, aseptata, 9.5-11.5 \times 7.5-9 μm , ad setulis hyalina up to 4.5 μm longa, ad apicem cellulae conidiogenae in massa mucosa aggregata.

HOLOTYPE in foliis viva *Bridelia scandens* Roxb. (Euphorbiaceae), Chorle Ghat, Goa, India, leg. Pratibha J., 2.7.2004, Herb. GUBH No. 1143.

Conidial fungi, hyphomycetes. *Leaf spots* amphigenous, scattered, irregular to circular, dark brown with a black spot in the center, 4-6 mm diam. *Colonies* on natural substrate effuse, dark brown, velvety. *Mycelium* immersed, composed of smooth, subhyaline,

septate, branched hyphae 2-2.5 μm wide. Conidiophores mononematous, erect, straight or flexuous, smooth, brown, thick-walled, 1-2-septate, unbranched, sometimes percurrently proliferating 1-2 times, 40-87.5 \times 5.5-8.5 μm . Conidiogenous cells terminal, integrated, monophialidic, cylindrical, smooth, 25.5-50 \times 5.8-8.5 μm , with flared conspicuous collarette. Conidia hyaline, thick-walled, angular, 0-septate, 9.5-11.5 \times 7.5-9 μm , with fine hyaline setulae up to 4.5 μm long at each angulate end, aggregating into a slimy mass at the tip of the phialide.

The fungus was brought into culture by sowing conidia on antibiotic-embedded 2% malt extract agar medium. The colony was slow growing, attaining a diam of 1-2 cm in 10 days, reddish brown at the center and pale brown towards the periphery, with superficial, floccose mycelium. The fungus did not produce any spore producing structures in culture.

Discussion

The diagnostic features of the species of *Bahusutrabeeja* are given in Table 1. *B. manoharacharii* can be compared with *B. angularis* in view of its angulate conidia. However, the conidia of *B. angularis* are smaller and 7-8 μm diam., whereas in the former it is 9.5-11.5 \times 7.5-9 μm . The conidiophores in *B. manoharacharii* are shortest of all species so far described in the genus. Further, *B. manoharacharii* is the first species recognized as foliicolous in the genus *Bahusutrabeeja*.

Table 1 Conidia and conidia producing structures of species of *Bahusutrabeeja*

Species	Conidiophore length	Phialide collaratte	Conidia : shape size	Conidial appendages Number and length
<i>B. angularis</i>	200-500	Well developed	Angular, 7-8 μm	3-5; up to 4 μm
<i>B. bunyensis</i>	Up to 210 μm	Well developed	Spherical, 7.5-10.5 μm	3; up to 5-9 μm
<i>B. dubhashii</i>	Up to 170 μm	Well developed	Obpyriform, 15-20 \times 5-8 μm	6; up to 18 μm
<i>B. dwaya</i>	170-290 μm	Well developed	Spherical, 12-14 μm	8-16; 4.5-12 μm
<i>B. globosa</i>	Up to 350 μm	inconspicuous	Spherical, 18-22 μm	9-12; 6.5-12.5 μm
<i>B. manoharacharii</i>	40 - 90 μm	Well developed	Rounded to angular, 9.5-11.5 \times 7.5-9 μm	4; up to 4.5 μm

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