
Diversity of saprobic hyphomycetes on *Proteaceae* and *Restionaceae* from South Africa

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To assess the diversity of saprobic microfungi occurring on the *Proteaceae* and *Restionaceae* of the Western Cape province of South Africa, samples of leaf, stem, flowerhead and culm litter were collected from the year 2000 until the end of 2002. About 1 000 fungal collections were made, 117 of which were hyphomycetes, representing 66 species in 53 genera. Of these, 49 species were newly recorded from South Africa, and 64 occurred on previously unreported host substrates. The diversity of hyphomycetes on *Proteaceae* and *Restionaceae* is discussed, together with a list of the hyphomycetes.

Key words: Cape Floral Kingdom, Fynbos, litter fungi.

Introduction

South Africa represents 1% of the earth's total land surface, but contains almost 10% of the world's total known bird, fish and plant species (Cock and Koch, 1991). The country has a wide range in climate and topography, spanning seven plant biomes: namely fynbos, savana, succulent karoo, nama-karoo, desert, grassland and forest (Low and Rebelo, 1996). The Western Cape, one of nine provinces of South Africa, is situated on the southwestern tip of the African continent. It shares six biomes of which the Fynbos biome accounts for about 50% of the land area (Fig. 1). The province has one of the six accepted floral kingdoms of the world, Cape Floral Kingdom (CFK), which is characterized by a high richness in plant species and high endemism, comparable or even surpassing many tropical forests in its floral diversity.

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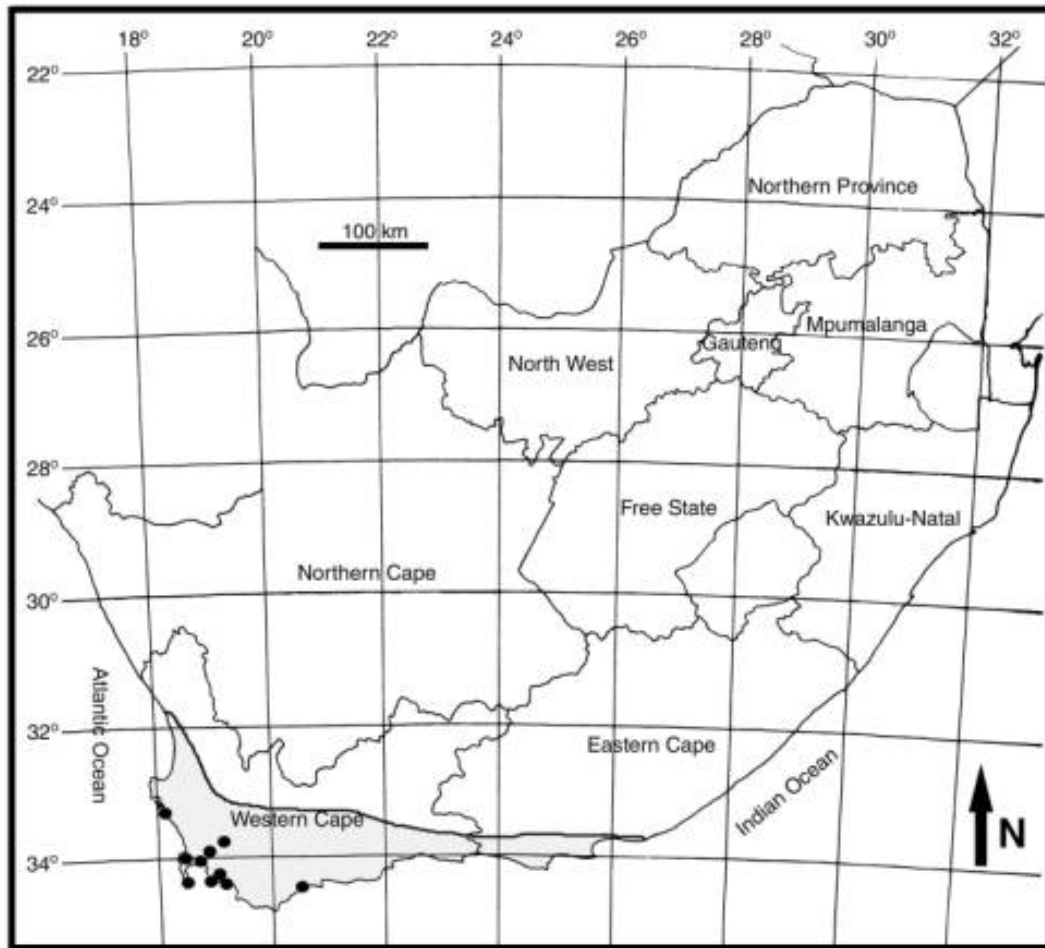


Fig. 1. Map of South Africa showing the provinces, the location of Cape Floral Kingdom (shaded) and collection sites (dots).

Seventy percent of the key vegetation groups in the CFK belong to the Fynbos biome (Cowling and Richardson, 1995). Its mediterranean climate, frequent fires, low soil nutrients and strong winds characterize this biome.

Proteaceae (proteas) in the dicotyledonous order *Proteales*, and *Restionaceae* (restios) in the monocotyledonous *Poales*, are typical elements of the Fynbos. Both families are largely restricted to the Southern Hemisphere. The proteas date to approximately 96 million years ago, and the restios to more than 60 million years ago (Cowling and Richardson, 1995). Both families are members of mega extinction groups. About 125 species of southern Africa's proteas and 16 species of restios are listed in the Red Data Book for plants (Hilton-Taylor, 1996). Furthermore, the whole Fynbos region is classified as critical, and has an endangered conservation status (Hilton-Taylor and Le

Roux, 1989). The restios fill the niche of true grasses in the CFK, comprising 4-5% of the total flora with more than 95% endemism (Haaksma and Linder, 2000). They were used as building materials in early ages and are still used for roofing materials and gardening, being extremely water efficient plants. The proteas are evergreen trees, shrubs or shrublets having flowers with bracts in compact heads. In South Africa they are used for landscaping and floral decoration, and the flowers are exported

The mycota of the Fynbos has been poorly studied. To date there have been no studies of saprobic hyphomycetes occurring in the Western Cape province, especially on proteas or restios. Although a few individual collections on different host substrates in the Fynbos were made (Crous, 1993; Crous and Van der Linde, 1993; Crous *et al.*, 1994, 1995, 1996).

The diversity of saprobic microfungi was explored from 2000 until the end of 2002 on dead parts of proteas and restios in nature reserves, botanical gardens, or other undisturbed areas in the Fynbos of the Western Cape province (Fig. 1). Results relating to coelomycetes and ascomycetes have been published (Lee and Crous 2003a,b,c,d; Lee *et al.*, 2003; Mel'nik *et al.*, 2004). Over 1000 fungal collections were obtained, of which 117 were found to represent 66 hyphomycete species distributed in 53 genera. A list of hyphomycetes on new South African records or on new host records is provided, and patterns of hyphomycete diversity on proteas and restios are discussed.

Materials and methods

Leaf, twig and flowerhead litter of 20 protea species, and culm litter of 19 restio species were collected from the ground surface or from standing plants (Table 1). A paper bag (12.5 × 8 × 26 cm) full of material was taken as sample from each respective host at each collection site. The stage of decomposition was senescent and freshly fallen or decomposing. Direct observation of specimens were made immediately for fungal structures or air-dried for further study. Air-dried specimens were incubated in moist chambers for 1-3 days before examination. A Nikon microscope with differential interference contrast (DIC) was used for microscopic observations. Measurements were made from specimens mounted in clear lactophenol. The 95% confidence intervals were derived from 30 observations wherever possible to determine the size of structures, with the extremes given in parentheses. Herbarium specimens are deposited at PREM (National Collection of Fungi, Pretoria, South Africa) and LE (Komarov Botanical Institute, St. Petersburg, Russia) and reference cultures are maintained in the culture collection of the

Table 1. List of host plant species.

Restios (<i>Restionaceae</i>, <i>Poales</i>)	Proteas (<i>Proteaceae</i>, <i>Proteales</i>, <i>Rosidae</i>)
<i>Calopsis</i> sp.	<i>Brabejum stellatifolium</i>
<i>Cannomois virgata</i>	<i>Leucadendron laureolum</i>
<i>Ceratocaryum decipiens</i>	<i>Leucadendron salignum</i>
<i>Elegia capensis</i>	<i>Leucadendron</i> sp.
<i>Elegia cuspidata</i>	<i>Leucadendron xanthoconus</i>
<i>Elegia equisetacea</i>	<i>Leucospermum conocarpodendron</i>
<i>Elegia</i> sp.	<i>Leucospermum praecox</i>
<i>Ischyrolepis</i> cf. <i>gaudichaudiana</i>	<i>Leucospermum</i> sp.
<i>Ischyrolepis</i> cf. <i>sieberi</i>	<i>Mimetes cucullata</i>
<i>Ischyrolepis subverticellata</i>	<i>Protea amplexicaulis</i>
<i>Restio dispar</i>	<i>Protea burchellii</i>
<i>Restio egregious</i>	<i>Protea cynaroides</i>
<i>Restio filiformis</i>	<i>Protea laurifolia</i>
<i>Restio quadratus</i>	<i>Protea lepidocarpodendron</i>
<i>Rhodocoma capensis</i>	<i>Protea magnifica</i>
<i>Thamnochortus</i> cf. <i>insignis</i>	<i>Protea neriifolia</i>
<i>Thamnochortus spicigerus</i>	<i>Protea nitida</i>
<i>Thamnochortus erectus</i>	<i>Protea obtusifolia</i>
Unknown restio	<i>Protea repens</i>
	<i>Protea</i> sp.

Centraalbureau voor Schimmelcultures (CBS) in Utrecht, the Netherlands. The hierarchical status and authorities of host plants are according to the international plant name index (<http://www.ipni.org/index.htm>). Presumed new, unpublished fungal species awaiting further study are marked as such. Isolates of *Fusarium*, *Penicillium*, and *Coniosporium* were not identified to species level.

Simple correspondence analysis on a full data matrix of fungal species and host families, and another correspondence and cluster analyses on a reduced data matrix with combination variables of sites and host families (fungal species with less than two collections were excluded) were performed to investigate the patterns of fungal distribution between the two host families using MVSP (Kovach, 2003). The Jaccard coefficient was calculated to quantify community similarity based on the presence or absence of species, and species diversity on the two host families (Brower *et al.*, 1998). The Margalef Diversity Index was taken as measurement of species richness. The Simpson diversity and Shannon diversity indices were calculated, taking into consideration both the number of species, and the evenness of occurrence of individuals in various species. The Simpson evenness and Shannon evenness indices were estimated to establish the closeness of a set of observed species to the maximum possible species diversity.

Results

Sixty-six hyphomycete species were collected from either proteas or/and restios during this study. Taxa are arranged in alphabetical order, with notes indicating previous records from South Africa.

Arthrinium phaeospermum (Corda) M.B. Ellis, Mycol. Pap. 103: 8 (1965).

Material examined: SOUTH AFRICA, Western Cape province, Darling, on a dead culm of undetermined restio, 29 June 2001, S. Lee SL773 (PREM 58025); Helderberg Nature Reserve, on dead culms of *Calopsis* sp., 4 May 2002, S. Lee SL1159 (PREM 58039); on dead culms of *Elegia capensis*, 13 April 2002, S. Lee SL1126 (PREM 58027); on dead culms of *Restio quadratus*, 13 April 2002, S. Lee SL1109 (PREM 58026), culture (CBS 113335); Jonkershoek Nature Reserve, on dead culms of *Cannomois virgata*, 15 June 2001, S. Lee SL732 (PREM 58028), culture (CBS 113332); on dead culms of *Ischyrolepis* cf. *gaudichaudiana*, 31 July 2001, S. Lee SL861 (PREM 58029); J.S. Marais Nature Reserve, on dead culms of *Thamnochortus* cf. *insignis*, 31 July 2002, S. Lee SL1232 (PREM 58030); Kirstenbosch Botanical Garden, on a dead culm of *Ischyrolepis subverticellata*, 3 December 2001, S. Lee SL1009 (PREM 58033); on dead culms of *Restio dispar*, 3 December 2001, S. Lee SL980 (PREM 58032); on a dead culm of *Rhodocoma capensis*, 3 December 2001, S. Lee SL1074 (PREM 58034); on dead culms of *Thamnochortus spicigerus*, 3 December 2001, S. Lee SL913 (PREM 58031); Kogelberg Nature Reserve, on dead culms of *Ischyrolepis subverticellata*, 11 May 2001, S. Lee SL649 (PREM 58036); on dead culms of *Restio dispar*, 11 May 2001, S. Lee SL718 (PREM 58037); on dead culms of undetermined restio, 11 May 2001, S. Lee SL644 (PREM 58035), culture (CBS 113333); University of Stellenbosch Botanical Garden, on dead culms of *Ischyrolepis subverticellata*, 4 May 2002, S. Lee SL1156 (PREM 58038).

Bactrodesmium sp.

Material examined: SOUTH AFRICA, Western Cape province, Kleinmond, on dead twigs of *Protea cynaroides*, 11 July 2000, S. Lee SL299.

Bahusakala olivaceonigra (Berk. & Broome) Subram., [as '*olivaceo-nigra*'], J. Indian Bot. Soc. 37: 63 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Gordon's Bay, on dead leaves of *Protea neriifolia*, 26 June 2000, S. Lee SL189 (PREM 58040); Jonkershoek Nature Reserve, on dead leaves of *Leucadendron salignum*, 6 June 2000, S. Lee SL130 (PREM 58041).

Brachydesmiella sp.

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch National Botanical Garden, on dead culms of *Rhodocoma capensis*, 3 December 2001, S. Lee SL1064.

Chalara hughesii Nag Raj & W.B. Kendr., New Zealand J. Bot. 12: 118 (1974).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead culms of *Elegia capensis*, 13 April 2002, S. Lee SL1139 (PREM 57604, LE

212480), found with *Rhexodenticula elegiae*, *Trichocladium macrosporum* and *Pseudospiropes simplex*.

Notes: Reported on bark of dead wood, Gauteng province (Boshoff, 2002).

***Circinotrichum* sp.**

Material examined: SOUTH AFRICA, Western Cape province, University of Stellenbosch Botanical Garden, on dead culms of *Ischyrolepis subverticellata*, 4 May 2002, S. Lee SL1154, culture (CBS 113473).

***Cladosporium cladosporioides* (Fresen.) G.A. de Vries**, Contrib. Knowledge of the genus *Cladosporium* Link ex Fries: 57 (1952).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead leaves of *Leucospermum conocarpodendron*, 6 June 2000, S. Lee SL143 (PREM 58044); Helderberg Nature Reserve, on dead twigs of *Leucadendron* sp., 14 August 2000, S. Lee SL221.

Notes: Known from soil under *Acacia karroo*, Free State province (Papendorf, 1976).

***Cladosporium macrocarpum* Preuss**, Sturm's Deutschl. Flora 6: 27 (1848).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead twigs of *Leucadendron* sp., 14 August 2000, S. Lee SL177 (PREM 58045).

Notes: Known from soil of wheat fields, Free State province (Jooste, 1978).

***Coniosporium* sp.**

Sporodochia pulvinate, black. *Conidiophores* macronematous, meristematic, unbranched, pale brown. *Conidiogenous cells* integrated, terminal, cylindrical, pale brown. *Conidia* (16-)22-25(-33) × (10-)13-15(-18) µm (\bar{x} = 23.2 × 14.1 µm), subglobose, ellipsoidal, or irregular, muriform, mostly 3 transverse septa and 1-many longitudinal septa, pale to mid brown, verrucose, in basipetal chains.

Material examined: SOUTH AFRICA, Western Cape province, Cape Point National Park, on dead culms of *Thamnochortus erectus*, 4 December 2001, S. Lee SL1033.

***Conoplea fusca* Pers.**, Mycol. Eur. 1: 12 (1822).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead leaves of *Leucadendron salignum*, 6 June 2000, S. Lee SL127 (PREM 58047); on dead leaves of *Protea nitida*, 6 June 2000, S. Lee SL62 (PREM 58046), culture (CBS 113475); Kleinmond Nature Reserve, on a dead leaf of *Mimetes cucullata*, 11 July 2000, S. Lee SL545 (PREM 58048).

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

Material examined: SOUTH AFRICA, Western Cape province, University of Stellenbosch Botanical Garden, on dead culms of *Ischyrolepis subverticellata*, 4 May 2002, S. Lee SL1144.

Cryptocoryneum rilstonii M.B. Ellis, Mycol. Pap. 131: 2 (1972).

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch Botanical Garden, on dead culms of *Elegia equisetacea*, 3 December 2001, S. Lee SL928, culture (CBS 113641); on a dead culm of *Ischyrolepis subverticellata*, 3 December 2001, S. Lee SL1004 (PREM 58050); on dead culms of *Restio dispar*, 3 December 2001, S. Lee SL990 (PREM 58049).

Dendryphiella infuscans (Thüm.) M.B. Ellis, Dematiaceous Hyphomycetes: 500 (1971).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on dead flowerheads of *Leucadendron* sp., 11 July 2000, S. Lee SL465 (PREM 58052).

Dicranidion palmicola Matsush., Matsushima Mycol. Mem. 2: 7 (1981).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on a dead twig of *Leucadendron* sp., 3 November 2000, S. Lee SL446.

Dictyochaeta simplex (S. Hughes & W.B. Kendr.) Hol.-Jech., Folia Geobot. Phytotax. 19: 434 (1984).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead bark of *Protea nitida*, 14 August 2000, S. Lee SL266 (PREM 58055), found with *Helicomyces roseus*; Kirstenbosch Botanical Garden, on a dead culm of *Elegia equisetacea*, 3 December 2001, S. Lee SL951 (PREM 58057); on a dead culm of *Thamnochortus spicigerus*, 3 December 2001, S. Lee SL906 (PREM 58056).

Notes: One previous record on dead wood, Eastern Cape province (Morgan-Jones *et al.*, 1992).

Drechslera erythrospila (Drechsler) Shoemaker, Can. J. Bot. 37: 880 (1950).

Material examined: SOUTH AFRICA, Western Cape province, J.S. Marais Nature Reserve, on a dead flowerhead of *Protea burchellii*, 6 June 2000, S. Lee SL102 (PREM 58058)

Epicoccum nigrum Link, Mag. Ges. naturf. Freunde. Berlin 7: 32 (1815).

Material examined: SOUTH AFRICA, Western Cape province, Darling, on dead culms of undetermined restio, 29 June 2001, F. Roets SL769 (PREM 58060); Helderberg Nature Reserve, on dead culms of *Calopsis* sp, 4 May 2002, S. Lee SL1166 (PREM 58061); Jonkershoek Nature Reserve, on a dead culm of *Cannomois virgata*, 15 June 2001, S. Lee SL738; on dead culms of *Elegia capensis*, 15 June 2001, S. Lee SL809; on a dead leaf of *Leucospermum conocarpodendron*, 6 June 2000, S. Lee SL147 (PREM 58062).

Notes: Although this fungus has been rarely reported in literature from South Africa (Opperman and Wehner, 1994), it is common.

Everhartia hymenuloides Sacc. & Ellis, *Michelia* 2: 580 (1880).

Material examined: SOUTH AFRICA, Western Cape province, Cape Point National Park, on dead culms of *Thamnochortus erectus*, 4 December 2001, S. Lee SL1032 (PREM 58063); Betty's Bay, on a dead leaf of *Leucospermum* sp., 26 June 2000, S. Lee SL612 (PREM 58064); Helderberg Nature Reserve, on a dead twig of *Protea obtusifolia*, 14 August 2000, S. Lee SL258 (PREM 58065), culture (CBS 113640); Kleinmond Nature Reserve, on a dead leaf of *Protea cynaroides*, 11 July 2000, S. Lee SL547; Kogelberg Nature Reserve, on a dead culm of undetermined restio, 11 May 2001, S. Lee SL659 (PREM 58066).

Exserticlava vasiformis (Matsush.) S. Hughes, *New Zealand J. Bot.* 16: 332 (1978).

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch National Botanical Garden, on dead culms of *Elegia equisetacea*, 3 December 2001, S. Lee SL931.

Fusarium spp.

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead culms of *Cannomois virgata*, 15 June 2001, S. Lee SL734; Harold Porter National Botanical Garden, on dead culms of *Elegia cuspidata*, 30 November 2001, S. Lee SL1055; Kirstenbosch National Botanical Garden, on dead culms of *Thamnochortus spicigerus*, 3 December 2001, S. Lee SL904; Kogelberg Nature Reserve, on dead culms of *Restio egregious*, 11 May 2001, S. Lee SL702.

Gliocladium solani (Harting) Petch, *Trans. Br. Mycol. Soc.* 27: 149 (1945).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead flowerhead of *Protea nitida*, 6 June 2000, S. Lee SL50 (PREM 58067), culture (CBS 113336).

Graphium calicioides (Fr.) Cooke & Masee, *Grevillea* 16: 11 (1887).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on dead flowerheads of *Leucadendron* sp., 3 November 2000, S. Lee SL454.

Gyrothrix citricola Piroz., *Mycol. Pap.* 84: 19 (1962).

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch National Botanical Garden, on a dead culm of *Elegia equisetacea*, 3 December 2001, S. Lee SL950 (PREM 58069).

Gyrothrix grisea Piroz., *Mycol. Pap.* 84: 17 (1962).

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch National Botanical Garden, on dead culms of *Thamnochortus spicigerus*, 3 December 2001, S. Lee SL914 (PREM 58068).

Helicoma dennisii M.B. Ellis, *Mycol. Pap.* 87: 23 (1963).

Material examined: SOUTH AFRICA, Western Cape province, on dead wood of unidentified protea, 24 January 2002, V. Mel'nik SL1024 (PREM 58070).

Notes: One record on bark of dead wood, Western Cape province (Boshoff, 2002).

Helicomycetes roseus Link, Mga. Ges. naturf. Freunde. Berlin 3: 21 (1809).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead bark of *Protea nitida*, 14 August 2000, S. Lee SL266 (PREM 58055), found with *Dictyochoaeta simplex*; University of Stellenbosch Botanical Garden, on dead culms of *Ischyrolepis subverticellata*, 4 May 2002, S. Lee SL1158 (PREM 58071).

Notes: Reported on bark of dead wood, Western Cape province (Boshoff, 2002).

Helicomycetes tenuis Speg., Mus. Nac. Buenos Aires Anal. 20: 423 (1910).

Material examined: SOUTH AFRICA, Western Cape province, J.S. Marais Nature Reserve, on dead culms of *Thamnochortus cf. insignis*, 31 July 2002, S. Lee SL1219 (PREM 58072).

Helicosingula leucadendri P.S. van Wyk, Marasas, Baard & Knox-Dav., Trans. Br. Mycol. Soc. 84: 183 (1985).

Material examined: SOUTH AFRICA, Western Cape province, Rooi Els Hill, on living leaves of *Leucadendron* sp., 26 June 2000, S. Lee SL93 (PREM 58074); Jonkershoek Nature Reserve, on dead leaves of *Leucadendron salignum*, 6 June 2000, S. Lee SL166 (PREM 58075).

Notes: This fungus was originally described as a foliar pathogen of *Leucadendron* in South Africa (Van Wyk *et al.*, 1985).

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

Material examined: SOUTH AFRICA, Western Cape province, Stellenbosch Mountains, on dead leaves of *Protea burchellii*, 6 June 2000, S. Lee SL36 (PREM 58076), culture (CBS 113476); on dead leaves of *Protea laurifolia*, 1 July 2000, F. Roets SL199.

Notes: Reported on bark of dead wood, Western Cape province (Boshoff, 2002).

Lecanicillium lecanii (Zimm.) Zare & W. Gams, Nova Hedwigia 72: 51 (2001).

Material examined: SOUTH AFRICA, Western Cape province, Cape Point National Park, on a dead twig of *Leucospermum praecox*, 23 February 2001, S. Lee SL517 (PREM 58077).

Monodictys castaneae (Wallr.) S. Hughes, Can. J. Bot. 36: 785 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on a dead twig of *Protea laurifolia*, 14 August 2000, S. Lee SL280 (PREM 58078).

Monodictys fluctuata (Tandon & Bilgrami) M.B. Ellis, Mycol. Pap. 125: 5 (1971).

Material examined: SOUTH AFRICA, Western Cape province, Betty's Bay, on dead leaves of *Protea magnifica*, 11 July 2000, S. Lee SL326 (PREM 58079).

Monodictys putredinis (Wallr.) S. Hughes, Can. J. Bot. 36: 785 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Kleinmond, on dead twigs of *Protea cynaroides*, 11 July 2000, S. Lee SL292 (PREM 58080); Kogelberg Nature Reserve, on dead bark of *Leucospermum conocarpodendron*, 3 November 2000, S. Lee SL357 (PREM 58081).

Nigrospora sphaerica (Sacc.) E.W. Mason, Trans. Br. Mycol. Soc. 12: 158 (1927).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead culms of *Restio quadratus*, 13 April 2002, S. Lee SL1120 (PREM 58082), found with *Arthrinium phaeospermum*; Kirstenbosch National Botanical Garden, on a dead culm of *Thamnochortus spicigerus*, 3 December 2001, S. Lee SL915 (PREM 58083).

Parasarcopodium ceratocaryi Melnik, S. Lee & Crous, Mycological Progress 3: 22 (2004).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead culms of *Ceratocaryum decipiens*, 15 July 2001, S. Lee SL731 (PREM 57603, LE 212441), culture (CBS 110664).

Penicillium spp.

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead flowerhead of *Protea repens*, 24 May 2000, S. Lee SL110; Kogelberg Nature Reserve, on dead culms of undetermined restio, 11 May 2001, S. Lee SL646; Stellenbosch Mountains, on a dead flowerhead of *Protea laurifolia*, 1 July 2000, F. Roets, SL199.

Periconia digitata (Cooke) Sacc., Syll. fung. 4: 274 (1886).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead culm of *Cannomois virgata*, 15 June 2001, S. Lee SL752 (PREM 58085).

Notes: This fungus has previously been recorded on dead leaves of unknown *Poaceae* and *Cenchrus*, and soils of the Fynbos (Allsopp *et al.*, 1987; Sinclair, 1990).

Periconia laminella E.W. Mason & M.B. Ellis, Mycol. Pap. 56: 120 (1953).

Material examined: SOUTH AFRICA, Western Cape province, Darling, on a dead culm of undetermined restio, 29 June 2001, F. Roets SL772 (PREM 58087), culture (CBS 114998).

Periconia lateralis M.B. Ellis & Everh., J. Mycol. 2: 104 (1886).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead culm of *Cannomois virgata*, 15 June 2001, S. Lee SL733 (PREM 58088), culture (CBS 114997).

Periconiella sp.

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on dead culms of *Restio filiformis*, 15 June 2001, S. Lee SL776; Kogelberg Nature

Reserve, on dead culms of *Ischyrolepis subverticellata*, 11 May 2001, S. Lee SL641, culture (CBS 113477).

Periconiella velutina (G. Winter) Sacc., Atti Ist. Veneto Sci., Ser. 6, 3: 727 (1885).

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch National Botanical Garden, on living leaves of *Brabejum stellatifolium*, 26 January 2002, V. Mel'nik SL961 (PREM 58089, LE 226014).

Phaeoisaria clematidis (Fuckel) S. Hughes, Can. J. Bot. 36: 794 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Gordon's Bay, on dead flowerheads of *Protea neriifolia*, 26 June 2000, F. Roet, SL173, culture (CBS 113340); Kogelberg Nature Reserve, on a dead flowerhead of *Leucadendron* sp., S. Lee SL451; on dead flowerheads of *Protea lepidocarpodendron*, 3 November 2000, S. Lee SL375 (PREM 58090).

Notes: This fungus has previously recorded on *Wisteria*, *Podocarpus* and dead wood from Gauteng, Free State and Western Cape provinces (Sinclair, 1990; Crous *et al.*, 1996; Boshoff, 2002).

Pithomyces atro-olivaceus (Cooke & Harkn.) M.B. Ellis, Mycol. Pap. 76: 8 (1960).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on dead culms of undetermined restio, 11 May 2001, S. Lee SL662 (PREM 58091), culture (CBS 113337).

Pithomyces chartarum (Berk. & M.A. Curtis) M.B. Ellis, Mycol. Pap. 76: 13 (1960).

Material examined: SOUTH AFRICA, Western Cape province, Harold Porter National Botanical Garden, on dead culms of *Elegia cuspidata*, 30 November 2001, S. Lee SL1059 (PREM 58092).

Notes: Recorded on dead leaves of *Sporobolus*, *Lolium*, *Medicago* and seed of *Medicago* (Marasas and Schumann, 1975). The teleomorphic state, *Leptosphaerulina chartarum* Ces. Roux, was reported as a pathogen to *Tribulus terrestris* Linn. (Roux, 1986)

Pithomyces valparadisiacus (Speg.) P.M. Kirk, Trans. Br. Mycol. Soc. 80: 460 (1983).

Material examined: SOUTH AFRICA, Western Cape province, Cape Point National Park, on dead twigs and a flowerhead of *Leucospermum praecox*, 23 February 2001, S. Lee SL516 (LE 212433); Helderberg Nature Reserve, on dead culms of *Calopsis* sp. 4 May 2002, S. Lee SL1161 (PREM 58093, LE 212563); Kirstenbosch National Botanical Garden, on dead culms of *Ischyrolepis subverticellata*, 3 December 2001, S. Lee SL998 (PREM 58094); on dead culms of *Restio dispar*, 3 December 2001, S. Lee SL936 (PREM 58095, LE 212406), culture (CBS 113331); on dead culms of *Rhodocoma capensis*, 3 December 2001, S. Lee SL1066 (PREM 58096); Kogelberg Nature Reserve, on a dead flowerhead of *Leucadendron*

sp., S. Lee SL450, culture (CBS 113338); on dead flowerheads of *Protea lepidocarpodendron*, 3 November 2000, S. Lee SL364 (PREM 58097), culture (CBS 113339).

Polyschema clavulata (Cooke & Harkn.) M.B. Ellis, More Dematiaceous Hyphomycetes: 370 (1976).

Material examined: SOUTH AFRICA, Western Cape province, Kleinmond, on a dead twig of *Protea cynaroides*, 11 June 2000, S. Lee SL293 (PREM 58098).

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

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on a dead culm of *Elegia capensis*, 13 April 2002, S. Lee SL1139 (PREM 57604, LE 212480), found with *Rhexodenticula elegiae*, *Trichocladium macrosporum* and *Chalara hughesii*; J.S. Marais Nature Reserve, on dead culms of *Thamnochortus* cf. *insignis*, 31 June 2002, S. Lee SL1236 (PREM 58099).

Notes: Recorded on bark and twigs, Western Cape and Northern provinces (Boshoff, 2002).

Ramichloridium anceps (Sacc. & Ellis) de Hoog, Stud. Mycol. 15: 77 (1977).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead culm of *Cannomois virgata*, 15 June 2001, S. Lee SL741 (PREM 58100), culture (CBS 114996).

Rhexodenticula elegiae Melnik, S. Lee & Crous, Mycological Progress 3: 77 (2004).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead culms of *Elegia capensis*, 13 April 2002, S. Lee SL1139 (PREM 57604, LE 212480), found with *Pseudospiropes simplex*, *Trichocladium macrosporum* and *Chalara hughesii*.

Septosporium bulbotrichum Corda, Icon. fung. 1: 12 (1837).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on a dead twig of *Leucospermum conocarpodendron*, 3 November 2000, S. Lee SL362 (PREM 58101).

***Sporidesmium* sp. 1**

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on a dead flowerhead of *Protea lepidocarpodendron*, 14 August 2000, S. Lee SL368.

***Sporidesmium* sp. 2**

Material examined: SOUTH AFRICA, Western Cape province, Betty's Bay, on dead leaves of *Protea magnifica*, 11 July 2000, S. Lee SL323.

***Sporidesmium* sp. 3**

Material examined: SOUTH AFRICA, Western Cape province, Outenuqua Nature Reserve, on dead culms of *Elegia* sp., 4 June 2002, A. Wood SL1215.

Stachybotrys albipes (Berk. & Broome) S.C. Jong & Davis, Mycotaxon 3: 425 (1976).

Material examined: SOUTH AFRICA, Western Cape province, Kirstenbosch National Botanical Garden, on a dead flowerhead of *Protea amplexicaulis*, 10 April 2001, P.W. Crous SL618.

Taeniolella stilbospora (Corda) S. Hughes, Can. J. Bot. 36: 817 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead twigs of *Protea burchellii*, 14 Aug. 2000, S. Lee SL216 (PREM 58102).

Taeniolella stricta (Corda) S. Hughes, Can. J. Bot. 36: 817 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead twigs of *Leucadendron* sp., 14 August 2000, S. Lee SL206 (PREM 58103).

Tetraploa aristata Berk. & Broome, Ann. Mag. Nat. Hist. 2, 5: 459 (1850).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead culms of *Elegia capensis*, 13 April 2002, S. Lee SL1132 (PREM 58104).

Notes: This fungus has been recorded on *Syzygium*, *Cenchrus* and dead wood from Gauteng and the Eastern Cape province (Sinclair, 1990).

Thysanophora penicillioides (Roum.) W.B. Kendr., Can. J. Bot. 39: 820 (1961).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on dead culms of *Calopsis* sp. 4 May 2002, S. Lee SL1163 (PREM 58105).

Torula herbarum f. quaternella Sacc., Ann. Mycol. 11: 556 (1913).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on a dead flowerhead of *Protea lepidocarpodendron*, 3 Nov. 2000, S. Lee SL376 (PREM 58106).

Trichobotrys effusa (Berk. & Broome) Petch, Ann. Roy. Bot. Gard. (Peradeniya) 9: 169 (1924).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead culm of *Cannomois virgata*, 15 June 2001, S. Lee SL740 (PREM 58107).

Notes: Known on decorticated wood, Gauteng province (Sinclair, 1990).

Trichocladium macrosporum P.M. Kirk, Trans. Br. Mycol. Soc. 76: 84 (1981).

Material examined: SOUTH AFRICA, Western Cape province, Helderberg Nature Reserve, on a dead culm of *Elegia capensis*, 13 April, 2002, S. Lee SL1139 (PREM 57604, LE 212480), found with *Rhexodenticula elegiae*, *Pseudospiropes simplex* and *Chalara hughesii*.

Trichoderma koningii Oudem., Arch. Néerl. Sci. Exact. Nat. 2, 7: 291 (1902).

Material examined: SOUTH AFRICA, Western Cape province, Kleinmond, on dead leaves of *Leucadendron* sp., 11 July 2000, S. Lee SL527 (PREM 58108).

Trichothecium roseum (Pers.) Link, Mag. Ges. naturf. Freunde. Berlin 3: 18 (1809).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on a dead twig of *Leucadendron xanthoconus*, 3 November 2000, S. Lee SL402 (PREM 58109), culture (CBS 113334); Rooiels Hill, on dead twigs of *Leucadendron laureolum*, 26 June 2000, S. Lee SL477 (PREM 58110).

Notes: This fungus has been recorded on dead leaves of *Poaceae* (Sinclair, 1990), and other substrates (Doidge, 1950; Gorter, 1979).

Trimmatostroma undulatum (McAlpine) J.L. Crane & Schokn., Mycologia 78: 86 (1986).

Material examined: SOUTH AFRICA, Western Cape province, De Hoop Nature Reserve, on dead culms of *Restio quadratus*, 28 February 2002, A. Wood SL1098.

Xylohypha ferruginosa (Corda) S. Hughes, Can. J. Bot. 36: 824 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Jonkershoek Nature Reserve, on a dead culm of *Ischyrolepis* cf. *sieberi*, 15 June 2001, S. Lee SL803 (PREM 58111).

Zygosporium gibbum (Sacc., M. Rousseau & E. Bommer) S. Hughes, Can. J. Bot. 36: 825 (1958).

Material examined: SOUTH AFRICA, Western Cape province, Kogelberg Nature Reserve, on dead leaves of *Brabejum stellatifolium*, 3 November 2000, S. Lee SL379 (PREM 58112, LE 212543).

Diversity of saprobic hyphomycetes on proteas and restios

A total of 117 (12%) out of approximately 1 000 fungal collections comprised hyphomycete taxa. Sixty-six species in 53 genera were composed of 36 species (30 genera) on restios and 36 species (31 genera) on proteas (Table 2). Forty-four genera were represented by only one species and 46 species were represented by only one collection. The most common genera were *Arthrinium* (13% of the total collections), *Pithomyces* (8%), *Epicoccum* (4%) and *Everhartia* (4%). The genera with high species diversity were *Pithomyces*, *Monodictys*, *Periconia* and *Sporidesmium* each with three species, followed by *Helicomyces*, *Cladosporium*, *Taeniolella*, *Periconiella*, and *Gyrothrix* each with two species (Table 2). The diversity of the fungal species present on two host plant groups is compared (Table 3). The hyphomycete community on proteas was more diverse than on restios in all indices (Table 3).

Table 2. Number of collections of hyphomycete species from two host plant families.

Fungal species	No. of collections		
	Restios	Proteas	Groups*
<i>Arthrinium phaeospermum</i>	15	0	A
<i>Bactrodesmium</i> sp. §	0	1	H
<i>Bahusakala olivaceonigra</i>	0	2	H
<i>Brachydesmiella</i> sp. §	1	0	A
<i>Chalara hughesii</i>	1	0	A
<i>Circinotrichum</i> sp. §	1	0	A
<i>Cladosporium cladosporioides</i>	0	2	H
<i>Cladosporium macrocarpum</i>	0	1	H
<i>Coniosporium</i> sp.	1	0	A
<i>Conoplea fusca</i>	0	3	H
<i>Corynespora cassiicola</i>	1	0	A
<i>Cryptocoryneum rilstonii</i>	3	0	A
<i>Dendryphiella infuscans</i>	0	1	H
<i>Dicranidion palmicola</i>	0	1	H
<i>Dictyochaeta simplex</i>	2	1	C
<i>Drechslera erythrospila</i>	0	1	H
<i>Epicoccum nigrum</i>	4	1	B
<i>Everhartia hymenuloides</i>	2	3	F
<i>Exserticlava vasiformis</i>	1	0	A
<i>Fusarium</i> spp.	4	0	A
<i>Gliocladium solani</i>	0	1	H
<i>Graphium calicioides</i>	0	1	H
<i>Gyrothrix citricola</i>	1	0	A
<i>Gyrothrix grisea</i>	1	0	A
<i>Helicoma dennisii</i>	0	1	H
<i>Helicomycetes roseus</i>	1	1	E
<i>Helicomycetes tenuis</i>	1	0	A
<i>Helicosingula leucadendri</i>	0	2	H
<i>Heteroconium solaninum</i>	0	2	H
<i>Lecanicillium lecanii</i>	0	1	H
<i>Monodictys castaneae</i>	0	1	H
<i>Monodictys fluctuata</i>	0	1	H
<i>Monodictys putredinis</i>	0	2	H
<i>Nigrospora sphaerica</i>	2	0	A
<i>Parasarcopodium ceratocaryi</i>	1	0	A
<i>Penicillium</i> spp.	1	2	G
<i>Periconia digitata</i>	1	0	A
<i>Periconia laminella</i>	1	0	A
<i>Periconia lateralis</i>	1	0	A
<i>Periconiella</i> sp. §	2	0	A

Table 2 continued. Number of collections of hyphomycete species from two host plant families.

Fungal species	No. of collections		
	Restios	Proteas	Groups*
<i>Periconia lateralis</i>	1	0	A
<i>Periconiella</i> sp. §	2	0	A
<i>Periconiella velutina</i>	0	1	H
<i>Phaeoisaria clematidis</i>	0	3	H
<i>Pithomyces atro-olivaceus</i>	1	0	A
<i>Pithomyces chartarum</i>	1	0	A
<i>Pithomyces valparadisiacus</i>	4	3	D
<i>Polyschema clavulata</i>	0	1	H
<i>Pseudospiropes simplex</i>	2	0	A
<i>Ramichloridium anceps</i>	1	0	A
<i>Rhexodenticula elegiae</i>	1	0	A
<i>Septosporium bulbotrichum</i>	0	1	H
<i>Sporidesmium</i> sp. 1 §	0	1	H
<i>Sporidesmium</i> sp. 2 §	0	1	H
<i>Sporidesmium</i> sp. 3 §	1	0	A
<i>Stachybotrys albipes</i>	0	1	H
<i>Taeniolella stilbospora</i>	0	1	H
<i>Taeniolella stricta</i>	0	1	H
<i>Tetraploa aristata</i>	1	0	A
<i>Thysanophora penicillioides</i>	1	0	A
<i>Torula herbarum</i> f. <i>quaternella</i>	0	1	H
<i>Trichobotrys effusa</i>	1	0	A
<i>Trichocladium macrosporium</i>	1	0	A
<i>Trichoderma koningii</i>	0	1	H
<i>Trichothecium roseum</i>	0	2	H
<i>Trimmatostroma undulatum</i>	1	0	A
<i>Xylohypha ferruginosa</i>	1	0	A
<i>Zygosporium gibbum</i>	0	1	H
Total: 66 species (53 genera)	66	51	

§ presumed new and unpublished species.

* groups indicated in Fig. 2.

Hyphomycetes were collected from 19 species (9 genera) of restios, and 20 species (5 genera) of proteas (Table 1). The number of fungi collected was 1:4 ratio of host species to fungi in restios and 1:3 in proteas. The correspondence analysis produced a one-dimensional representation of the data. However, 81% of the inertia was contained in this one dimension. Most species belonged to either host group, and a few to both host groups (Fig. 2). Species fell into eight groups: A represents 30 species found only on restios, H

Table 3. Measurement of species richness, and diversity of the host groups, proteas and restios.

Indices	Restios	Proteas
No. of species	36	36
No. of individuals	66	51
Margalef diversity index	19.23	20.50
Simpson diversity index (1/Ds)	16.37	67.11
Shannon diversity index (H')	1.38	1.51
Evenness using Ds (ED)	0.95	0.99
Evenness using H' (J')	0.88	0.96

represents 30 species found only on proteas. Letters from B to G represent one species each occurring on both host groups: *Epicoccum nigrum* (B, 80% of total individuals occurs on restios), *Dictyochaeta simplex* (C, 66%), *Pithomyces valparadisiacus* (D, 57%), *Helicomyces roseus* (E, 50%), *Everhartia hymenuloides* (F, 67%) and *Penicillium* spp. (G, 33%). Ordination on a reduced data matrix yielded results where 42% of inertia of the data set was explained by the first three axes of the plot (data not shown). Similarly, cluster analysis using UPGMA and standardized Euclidean distance did not yield clear clustering pattern (data not shown). The Jaccard similarity coefficient was 0.09.

Discussion

Hyphomycetes are a major component of the fungal community that is active in decomposing plant debris (Somrithipol *et al.*, 2002; Yanna *et al.*, 2002). During collecting trips we mostly encountered senescent, freshly fallen litter, at an early stage of decomposition, but never partially decomposed fermenting litter or highly decomposed humus. This may be due to the characteristics of fynbos, frequent fires and the long dry season, which prevents litter decomposing quickly. During decomposition various fungal populations are involved at different stages (Latter and Cragg, 1967; Fell and Hunter, 1979; Fryar, 2002; Promputtha *et al.*, 2002; Zhou and Hyde, 2002). Weak pathogens or endophytes initially colonize substrates and then saprobic litter species take over this niche that may eventually be colonized by typical soil fungi (Subramanian, 1983; Promputtha *et al.*, 2002). We isolated *Helicosingula leucadendri*, a highly specific foliicolous pathogen to *Leucadendron*, which confirms the early decomposing status of the fungal community.

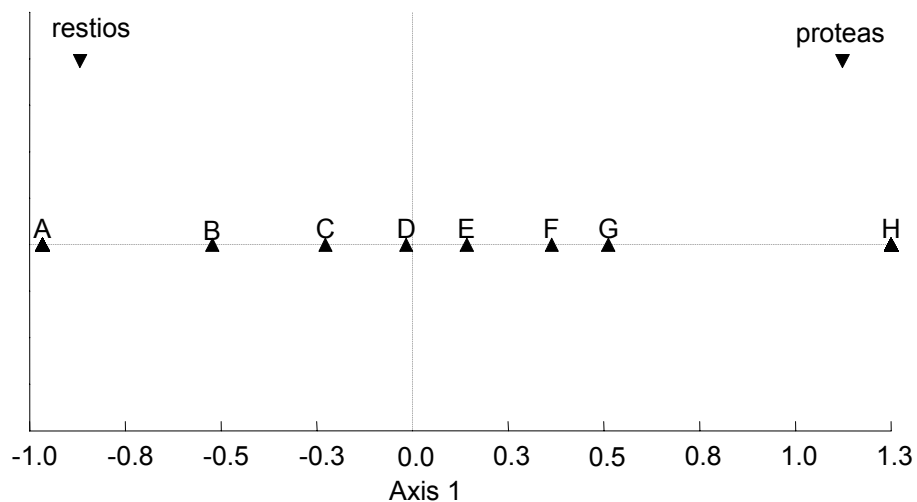


Fig. 2. One-dimensional corresponding ordination of fungal community present in the two host families, proteas and restios. The total variation or inertia of the data explained 81%. A to H indicates groups of hyphomycetes referred in Table 2.

Different techniques such as direct observation, washing and spore falling, each reveals a somewhat different fungal mycota and have been used to understand fungal communities in litter (Subramanian, 1983; Paulus *et al.*, 2003). We used the direct observation method and found only a few common hyphomycetes such as *Penicillium*, *Aspergillus* and *Cladosporium* that are frequently obtained by the washing techniques (Paulus *et al.*, 2003).

The proportional ratio of individual hyphomycetes to the total number of fungi collected (11% of total collections) was low. This agrees with other studies on various hosts in tropical or subtropical areas (McKenzie and Hyde, 1997; Taylor *et al.*, 2000) with lower percentages of hyphomycete occurrence when substrates have not reached the decomposed humus stage. Correspondence analysis on a full data matrix indicated that most of the hyphomycetes are uniquely present on either host group, and that there is low overlap of hyphomycete species (7% of the total hyphomycetes) between them. The Jaccard coefficient (0.09) supports the finding that most of the hyphomycetes are uniquely present on one or other of the two host groups. This implies the possibility of a relatively high degree of host-recurrence of hyphomycetes in the Fynbos. This finding has to be interpreted with caution, however, since there have been no studies on other fynbos host plants.

Fifty-six percent of the total specimens of hyphomycetes occurred on restios, although fewer host species were examined than proteas. Soft culm tissues of restios may allow easier colonization by hyphomycetes than the hard and leathery leaves or twigs of proteas. The diversity indices indicated that the

hyphomycete community on proteas is more diverse than that on restios pertaining to species richness, evenness, and the combined measure. The reason for low diversity indices of restios, despite higher number of individuals, is due to the presence of a dominant species, *Arthrinium phaeospermum* showing host recurrence in restios.

In our study and in previous studies of hyphomycetes in the Western Cape Province, several new genera and species have been found. From 1979 to 1986, Sinclair (1990) collected dead wood and leaf litter from indigenous forest habitats in the Eastern Cape and the Free State provinces. He recorded 64 hyphomycete species including 5 new genera and 17 new species to science. Of these, only six species were found during the present study. This is not surprising, because there is a significant variation in substrates from fynbos to indigenous forest plants, and in climates from mediterranean to summer-rain areas. Recently, Boshoff (2002) published a list of hyphomycetes on bark of dead wood collected in 1994 from grasslands, fynbos and savanna in Gauteng, Mpumalanga and the Western Cape provinces. A total of 59 species were collected, including one new genus, one new species, and 43 new South African records; only four of these were found in our study. Different fungal communities are involved in decomposition of leaves and bark (Subramanian, 1983; Promputtha *et al.*, 2002), and in our collections we did not have woody litter.

In a study of published records and preliminary findings of fungi associated with *Proteaceae*, Taylor *et al.* (2001) found few genera of fungi specific to *Proteaceae*. Those which showed host-specificity were generally leaf pathogens and were only specific at the level of host genus (Taylor *et al.*, 2001). Studies of hosts in tropical habitats have often revealed host-specificity of saprobic fungi at the fungal species, genus and sometimes family level (Zhou and Hyde, 2001; Yanna *et al.*, 2002). A degree of host-specificity was shown by Taylor *et al.* (2001) at the fungal species level, and it was postulated that there might be a pattern of unspecific, common or widespread fungal genera with protea-specific species. However, in the case of hyphomycetes, this does not appear to be the case. While there are pathogenic hyphomycete species and genera that are specific to *Proteaceae* (Taylor and Crous, 1998), the saprobic genera are not novel and only 6% of the species.

Both of Taylor *et al.* (2001)'s and our results correlate with the findings of a survey that looked at geographical patterns in the biodiversity of all groups of non-lichenised fungi (Lodge *et al.*, 1995). They reported that diversity was higher at low latitudes for hyphomycetes and in general for most ascomycetous fungi, particularly for epiphytic and parasitic leaf ascomycetes. This was also noted when biogeography of fungi was first discussed by Bisby (1943) and

later for conidial fungi by Wicklow (1981). However, when Wicklow (1981) analysed the distributions of 295 genera discussed by Ellis (1971), it was shown that most were located between latitudes 30°-45°N, i.e. temperate areas, with 51 of these genera (24%) occurring there exclusively. This was, however, attributed to the efforts made in collecting and in the distribution of mycologists. With the efforts that have been made in recent years to collect in the tropics, it is possible that the situation is different now. Wicklow (1981) noted that of the genera reported by Ellis (1971), the tropical genera were widespread and that in general there were not many examples of endemic anamorphic fungi.

Lodge *et al.* (1995) discussed precipitation, but only in terms of high or low rainfall, and not in terms of the seasonality of the precipitation, although it was acknowledged that this may be important. Some studies of diversity and distribution of soil mycota have taken rainfall seasonality into account, such as the study of *Fusarium* in soils across a climatic gradient in eastern Australia (Sangalang *et al.*, 1995), which recorded the lowest species diversity in the mediterranean winter rainfall region. A similar survey in South Africa found no significant difference between the numbers of isolates and species between different climatic areas, but significantly the lowest incidences of *Fusarium* were both from temperate, winter rainfall areas (Marasas *et al.*, 1988). In a study by Taylor *et al.* (2000), decomposing material from a temperate palm (occurring in warm temperate summer rainfall areas and cold temperate areas with year round rainfall) yielded more anamorphic fungi (58% of all species collected) compared to similar sampling of tropical palms (39-42% of all species collected). However, the proportion of hyphomycetes in the temperate areas was lower (25%) compared to the proportion of the total species recorded in tropical areas (28-30%) (Taylor *et al.*, 2000; Taylor and Hyde, 2003). Thus it is possible that hyphomycetes are less common in winter rainfall, mediterranean temperate areas than other temperate or tropical areas where rain falls all year or predominantly in the summer.

Lodge *et al.* (1995) noted that species diversity was strongly related to host diversity even amongst groups like saprobic hyphomycetes. However, it was pointed out that for fungi adapted to dry conditions, species diversity is less strongly related to host and habitat diversity. This may well be the case for the hyphomycetes in the Cape Floral Kingdom that tend to be dematiaceous and robust reflecting the harsh environment in which they exist, with hot dry summers.

A further point that Lodge *et al.* (1995) made and one that is possibly most relevant to this study on saprobic hyphomycetes was based on a theory by Huston (1994). This suggests that in decomposer communities, diversity would

be highest where plant productivity was greatest, irrespective of plant diversity. Lodge *et al.* (1995) suggested that this was not the case for fungi, other than perhaps ascomycetes due to the predominance of decomposers in this group. It would appear that this is almost certainly true for hyphomycetes in the Cape Floral Kingdom, particularly the Fynbos biome as this is characterised by low lying generally sparse, shrubby heathland vegetation. Therefore it is possible that Huston's hypothesis is applicable for ascomycetous fungi and their anamorphs in similar habitats in other Mediterranean areas.

We hope that further studies in the Fynbos with expanded host plants, a larger sampling, combined with different isolation techniques and different stages of decomposition in litters, will add additional data to the overall picture of behaviour of litter fungi and their role in the ecosystem, and that this will ultimately assist conservation efforts in the region, not only in aspects of floral and fauna but also of microbial communities.

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