

Systematics of selected foliicolous fungi associated with leaf spots of Proteaceae

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The present study treats several fungi associated with leaf spots of Proteaceae from Africa, Australia and India. *Leptosphaeria leucadendri* (anamorph: *Sclerostagonospora leucadendri*) is described from *Leucadendron* leaves from Australia, while three previously described African taxa from *Protea* leaves are transferred to *Phaeophleospora* as *P. abyssinicae*, *P. congestum* and *P. protearum*. *Trimmatostroma protearum* and a *Phyllosticta* sp. are described from *Protea* leaves collected in South Africa and Australia, respectively. *Cercospora agharkarii*, which occurs on *Grevillea*, is redispersed to *Pseudocercospora*, while a new genus *Pseudohendersonia*, is proposed for *P. proteae* occurring on *Protea* leaves in South Africa.

Knowledge of the fungi that occur on plants of the Proteaceae is important for many reasons. Proteaceae are cultivated extensively in South Africa, Zimbabwe, Australia, Israel and New Zealand. The U.S.A. is an economically important market for cut flowers of Proteaceae from many of these countries (Wessels *et al.*, 1997). Strict phytosanitary regulations in the U.S.A., however, frequently prevent infected material from reaching that market (Greenhalgh, 1981). Additionally, the cultivation of Proteaceae in the U.S.A. for the cut flower market is a small but growing industry, concentrated in Hawaii and California. Further development and expansion of this industry depends on obtaining disease-free germplasm from countries where these plants are indigenous. For both reasons it is important to document the fungi that occur on Proteaceae, and to know their distribution. Finally, because the Proteaceae are a major component on the Cape fynbos plant biome, which is the smallest most diverse, yet most significantly threatened plant biome in the world (Rebello, 1995), it is in the interest of conservationists and the Proteaceae industry to record all new diseases and potentially important pathogens. Although there have been papers dealing with diseases of Proteaceae in South Africa (Van Wyk, Marasas & Knox-Davies, 1975; Knox-Davies, 1981; Benic & Knox-Davies, 1983; Van Wyk, Marasas & Knox-Davies, 1985; Knox-Davies, Van Wyk & Marasas, 1987; Orffer & Knox-Davies, 1989; Serfontein & Knox-Davies, 1990; Crous & Wingfield, 1993; Swart *et al.*, 1998), the pathogens have been poorly studied, and little is known of diseases of Proteaceae in countries elsewhere in the world.

The present study, which is the second in a series (Swart *et al.*, 1998) describing new fungal taxa from Proteaceae, is based chiefly on an examination of specimens retained from commercial shipments of cut flowers exported to the U.S.A. which were found to have disease symptoms. In addition, type

specimens of several other insufficiently known pathogens of Proteaceae were re-examined and are dealt with here.

MATERIALS AND METHODS

All herbarium specimens examined are lodged at the U.S. National Fungus Collection, Beltsville, Maryland (BPI). For microscopic examination the fungi were mounted in lactophenol and water. Measurements were made from lactophenol preparations at 100× magnification. The 95% confidence intervals were derived from at least 30 observations, and ranges are given in parentheses.

DESCRIPTION OF SPECIES

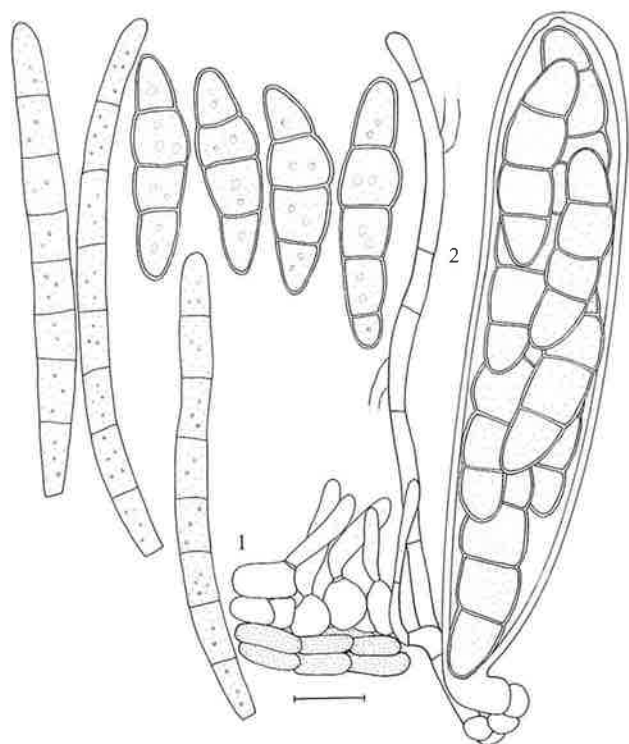
Lectosphaeria leucadendri Crous & M. E. Palm, sp. nov.

(Figs 1, 2)

Anamorph: *Sclerostagonospora leucadendri* Crous & M. A. Palm, sp. nov.

Ascomata sparsa, dispersa, globosa vel subglobosa, demum erumpentia usque 250 µm diam., 200 µm alta; pariete usque 30 µm crassum, stratis 8–12 texturae angularis. Asci numerosi, sessiles, cylindrico-clavati, 60–90 × 12–16 µm. Ascosporae fusioideae vel ellipsoideae, 3(–4)-septatae; luteo-brunneae, laeves, guttulatae, (20–)23–25(–28) × (5–)6–7 µm. Conidiomata pycnidialia, discreta, usque 150 µm lata et 130 µm alta. Cellulae conidiogenae discretae, percurrenter 1(–2)-plo proliferantes, hyalinae, laeves, ampulliformes vel doliiformes, 4–6 × 3.5–5 µm. Conidia pallide brunnea, tenuitunicata, cylindracea, laevia, guttulata, ad apicem obtusa, ad basem truncata vel obconico-truncata, (6–)7–9(–11)-septata, (45–)50–60(–70) × (3–)3.5–4(–5) µm.

Leaf spots amphigenous, up to 5 mm diam., subcircular, situated along leaf margins, grey, with a raised, dark brown border, surrounded by a diffuse red-purple margin. *Mycelium* immersed comprising of pale brown, smooth, branched, septate, hyphae, 2–3.5 µm. *Ascomata* sparse, scattered, globose

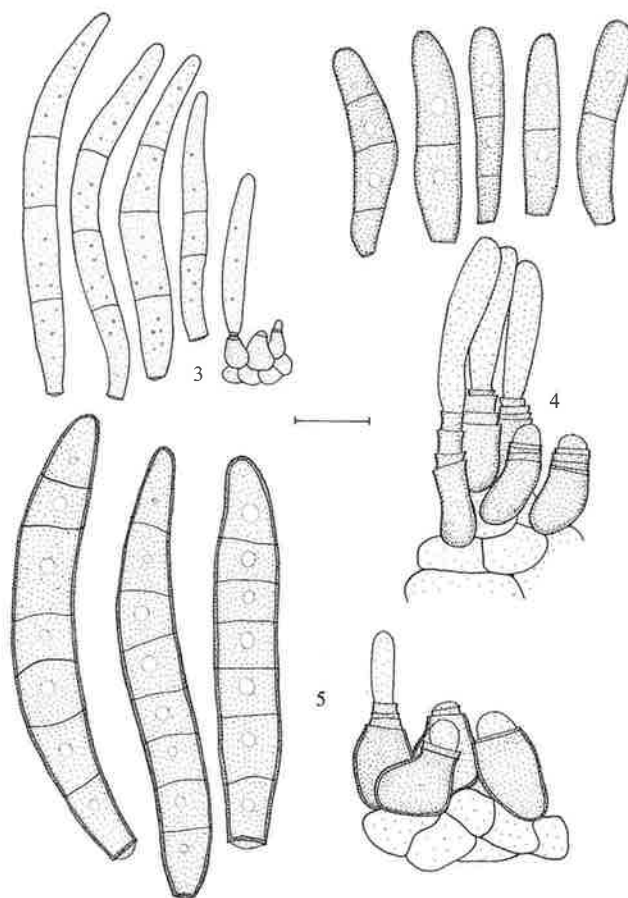


Figs 1, 2. *Leptosphaeria leucadendri* and its anamorph *Sclerostagonospora leucadendri* (BPI 802383). **Fig. 1.** Conidia and conidiogenous cells. **Fig. 2.** Ascus, ascospores and pseudoparaphysis. Bar = 10 μ m.

to subglobose, becoming erumpent, up to 250 μ m diam., 200 μ m high, with a central papillate ostiole, which is up to 60 μ m diam., wall up to 30 μ m diam., consisting of 8–12 layers of *textura angularis*, outer region of 5–8 layers of brown scleroplectenchymatic cells, inner region of 3–4 layers of hyaline, more elongated cells. *Pseudoparaphyses* numerous, initially attached to the top and bottom of the cavity, 1–3 μ m wide, septate, branched. *Asci* eight-spored, numerous, sessile, cylindric-clavate, thin-walled, short-stalked, apex rounded, 60–90 \times 12–16 μ m. *Ascospores* 2–3-seriate, fusoid to ellipsoid, straight to slightly curved with obtuse ends, 3(–4)-septate, primary septum median, subapical cell becoming slightly swollen, constricted at septa, yellow-brown, smooth, guttulate, (20–)23–25(–28) \times (5–)6–7 μ m. *Conidiomata* pycnidial, separate, up to 150 μ m wide, 130 μ m high, immersed, subcuticular, brown, thin-walled; wall up to 10 μ m thick, consisting of 2–3 layers of medium brown *textura angularis*; ostiole single, central. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* discrete, proliferating 1(–2)-times percurrently, hyaline, smooth, ampulliform to doliiform, formed from the inner layer of the pycnidial wall, 4–6 \times 3.5–5 μ m. *Conidia* holoblastic, pale brown, thin-walled, cylindrical, smooth, guttulate, straight to variously curved, (6–)7–9(–11)-septate, not constricted at septa, apex obtuse, base truncate or tapering from basal septum to an obconically truncate base, (45–)50–60(–70) \times (3–)3.5–4(–5) μ m.

Holotype: Australia, on living leaves of a *Leucadendron* sp., N. Armanious, 8 Mar. 1994, BPI 802383 A & B (of *L. leucadendri* and *S. leucadendri*, respectively).

Leptosphaeria is morphologically similar to *Phaeosphaeria*, but the two are considered distinct in that *Leptosphaeria sensu*



Figs 3–5. Conidia and conidiogenous cells of *Phaeophleospora* spp. **Fig. 3.** *P. abyssinicae* (BPI 38386). **Fig. 4.** *P. congestum* (BPI 368056). **Fig. 5.** *P. protearum* (BPI 374272). Bar = 10 μ m.

stricto has a thick ascomal wall of scleroplectenchymatic cells, and occurs primarily on dicotyledons (Shoemaker, 1984; Khashnobish & Shearer, 1996). *Leptosphaeria protearum* Syd. is also known from Proteaceae. *L. leucadendri* has similar ascospore dimensions (20–28 \times 5–7 μ m) to that of *L. protearum* (23–29 \times 6–7 μ m) (Van Wyk *et al.*, 1975), but the former has a *Sclerostagonospora* anamorph, whereas *L. protearum* has a *Coniothyrium* anamorph (Taylor & Crous, 1998). Several anamorph genera have been linked to *Leptosphaeria* (Sivanesan, 1984). The anamorph of *L. leucadendri* resembles species of *Stagonospora*, but has pigmented conidia, and is thus better placed in *Sclerostagonospora* (Sutton, 1980).

***Phaeophleospora abyssinicae* Crous & M. E. Palm, nom. nov.** (Fig. 3)

\equiv *Septoria proteae* Ciccar., *Mycopath. Mycol. Appl.* **5**: 229 (1951).

Leaf spots amphigenous, circular to subcircular, 3–4 mm diam., grey to light brown, with a raised, brown border. *Mycelium* internal, consisting of branched, septate, smooth, light brown hyphae, 2–3 μ m wide. *Conidiomata* pycnidial, amphigenous, substomatal, scattered, black, globose to subglobose, up to 100 μ m diam.; wall consisting of 2–3 layers of brown *textura angularis*. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* discrete, ampulliform to doliiform, light brown, finely verruculose, with 1–3 percurrent proliferations, 2.5–3.5 \times 2–3 μ m. *Conidia* holoblastic, solitary, narrowly

obclavate to subcylindrical, apex subobtuse, base truncate to long obconic-truncate, straight to flexuous, light brown, verruculose, indistinctly guttulate, (0-)1-3-euseptate, (17-)22-32(-38) × (2.5-)3-3.5 µm; minute basal marginal frill present.

Holotype: Ethiopia, Sidama, Didigsa, on leaves of *Protea gaguedi* J. F. Gmel (= *P. abyssinica*), 3 Dec. 1938, R. Ciferri Herb., BPI 38386.

In a re-examination of the type specimen of *Septoria proteae*, it was observed that the conidia were pigmented, verruculose, and produced by pigmented, finely verruculose, percurrently proliferating conidiogenous cells. The latter characters closely fit those ascribed to *Phaeophleospora* (Crous, Ferreira & Sutton, 1997). Because the name *P. proteae* (B. Sutton) Crous, F. A. Ferreira & B. Sutton already exists, *P. abyssinicae* is proposed as a *nomen novum* for *Septoria proteae* Ciccari.

Phaeophleospora congestum (Syd.) Crous & M. E. Palm, comb. nov. (Fig. 4)

≡ *Didymosporium congestum* Syd., *Ann. Mycol.* **10**: 45 (1912).

= *Coniothyrium proteae-abyssinicae* Bacc., *Ann. Bot.* **14**: 139 (1917).

= *Kirramyces proteae* B. Sutton, *Mycol. Pap.* **167**: 35 (1993).

≡ *Phaeophleospora proteae* (B. Sutton) Crous, F. A. Ferreira & B. Sutton, *S. Afr. J. Bot.* **63**: 115 (1997).

Leaf spots amphigenous, subcircular, up to 8 mm diam., medium brown with a light brown, slightly raised, sinuate border. *Mycelium* internal, consisting of branched, septate, smooth, light brown hyphae, 2-4 µm wide. *Conidiomata* amphigenous, pycnidial, ostiolate, subepidermal, scattered, dark brown to black, globose, unilocular, up to 150 µm diam.; wall consisting of 2-3 layers of brown *textura angularis*. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* discrete, cylindrical to lageniform, light to medium brown, verruculose, with 1-6 percurrent proliferations, 5-10 × 3-6 µm. *Macroconidia* holoblastic, solitary, cylindrical, straight to curved, (0-)1(-3)-euseptate, rarely guttulate, medium brown, verruculose, apex obtuse, base truncate to subtruncate with a marginal frill, (10-)12-22(-25) × 3-4(-4.5) µm. *Microconidia* (Sutton, 1993) not observed on type.

Specimens examined: South Africa, Mpumalanga, Diepkloof nr. Dullstroom, on leaves of *Protea caffra* Meisn., E. M. Doidge, 10 Sep. 1910, PREM 930 (holotype of *D. congestum*); Ethiopia, Wochi, on leaves of *Protea gaguedi* (= *P. abyssinica*), Baldradi 35, from the Ciferri Herb., Sep. 1914, BPI 368056 (holotype of *C. proteae-abyssinicae*).

Examination of the type specimens of *C. proteae-abyssinicae* and *D. congestum* indicate that they are the same fungus, as is *K. proteae*. The older epithet of *D. congestum* (1912) has priority. This species is typical of *Phaeophleospora* in that the conidiogenous cells are pigmented, roughened, and pycnidia extrude a black conidial mass (cirri), a character commonly observed on leaves infected by members of this genus. Measurements of the various fungal structures correspond closely with those given by Sutton (1993), who reported this species from Malawi on *Protea petiolaris* (Hiern.) Baker & Wright subsp. *elegans* Chisumpa & Brummitt.

Phaeophleospora protearum (Wakef.) Crous & M. E. Palm, comb. nov. (Fig. 5)

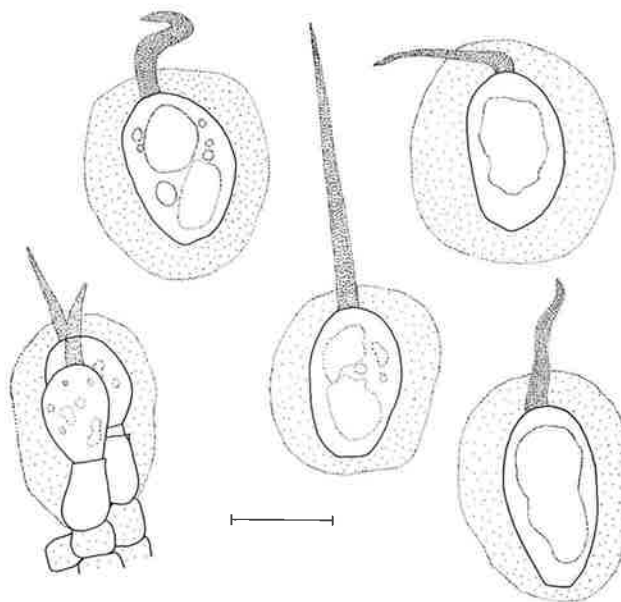


Fig. 6. Conidia and conidiogenous cells of a *Phyllosticta* sp. occurring on *Protea* (BPI 801971). Bar = 10 µm.

≡ *Hendersonia protearum* Wakef., *Kew Bull. Misc. Inform.* 1918: 210 (1918).

Leaf spots diffuse on type; pycnidia produced abundantly in necrotic leaf tissue. *Mycelium* internal, consisting of branched, septate, smooth, hyaline to light brown hyphae, 2.5-4 µm wide. *Conidiomata* amphigenous, scattered, pycnidial, substomatal, black, ostiolate, black, globose to subglobose, unilocular, up to 150 µm diam.; wall consisting of 2-3 layers of medium brown *textura angularis*; inner layer light brown. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* discrete, ampulliform or doliiform to subcylindrical, light brown, verruculose, with 1-5 percurrent proliferations, 5.5-11 × 5-7 µm. *Conidia* holoblastic, solitary, exuded in cirri (fallen flat on leaf surface of type), subcylindrical or narrowly ellipsoidal, straight to flexuous, tapering from the middle towards a narrowly truncate base, apex subobtuse to obtuse, medium brown, verruculose, guttulate, (1-)4-7-euseptate (30-)35-45(-50) × (5-)6-7 µm; base with minute marginal frill.

Holotype: Uganda, on dead leaves of *Protea madiensis* Oliv., R. Dummer 2866, Jul. 1916, BPI 37472.

Phaeophleospora protearum produces conidia that resemble those of *P. epicoccoides* (Cooke & Masee) Crous, F. A. Ferreira & B. Sutton that infects *Eucalyptus*, which are (15-)30-35(-55) × (4-)5-6 µm and (1-)3-5(-7)-euseptate (Crous, 1998). The two species can, however, be distinguished by differences in conidial shape and width, the conidia of *P. protearum* being slightly wider and having less taper from the middle to the apex of conidia.

***Phyllosticta* sp.** (Fig. 6)

Leaf spots amphigenous, circular, up to 6 mm diam., medium brown, with a medium brown, raised border. *Conidiomata* pycnidial, predominantly hypophyllous, scattered, immersed, globose to subglobose, up to 150 µm diam., unilocular, medium brown, ostiolate, become papillate; wall up to 12 µm thick, of medium brown *textura angularis*. *Conidiophores* reduced

to conidiogenous cells. *Conidiogenous cells* hyaline, smooth-walled, subcylindrical to doliiform, $3\text{--}5 \times 2.5\text{--}3 \mu\text{m}$. *Conidia* obovoid to ovoid, apex rounded, base with an inconspicuous flattened scar, hyaline, guttulate, $(8\text{--})10\text{--}12\text{--}(13) \times (5\text{--})6\text{--}7.5 \mu\text{m}$, enclosed in a prominent, persistent mucous sheath, $(2.5\text{--})3.5\text{--}4 \mu\text{m}$ thick, with a single, unbranched, tapering, apical mucoid appendage, $5\text{--}15\text{--}(30) \times 1\text{--}1.5 \mu\text{m}$.

This species is similar to *P. owaniana* G. Winter and *P. telopeae* H. Y. Yip. Conidia of the *Phyllosticta* sp. from *Protea* are smaller than those of *P. owaniana* [$(10\text{--})12\text{--}14\text{--}(15) \times 7\text{--}8\text{--}(9) \mu\text{m}$] and *P. telopeae* ($11.5\text{--}15.5 \times 7\text{--}10 \mu\text{m}$). The most obvious difference is the thick, persistent, mucous conidial sheath of *P. proteae*, which is thinner and less prominent on conidia of *P. owaniana* ($0.5\text{--}3 \mu\text{m}$ thick) and *P. telopeae* ($0.5\text{--}2 \mu\text{m}$ thick). Sheath and appendage dimensions have, however, been observed to vary greatly in *P. owaniana* and *P. telopeae* when cultured on different media. Furthermore, recent molecular studies (G. C. Carroll, pers. comm.) have indicated that there are species of *Phyllosticta* that have wide host ranges. We will, therefore, refrain from describing this species till more cultures and data have been obtained.

Specimens examined: Australia, on living leaf of a *Protea* sp., R. Antoun, 23 May 1993, BPI 801971. *Phyllosticta telopeae*, Australia, Tasmania, Newtown Research Laboratory Nursery, 94 Hobart Rd, on living leaves of *Telopea speciosissima*, H. Y. Yip, 10 Dec. 1987, DAR 62278 (holotype of *P. telopeae*). *Phyllosticta owaniana*, South Africa, Western Cape province, Jonkershoek, on living leaves of *Brabejum stellatifolium* L., A. den Breeÿen, Mar. 1995, PREM 55351, cultures STE-U 1009–1010, IMI 375228, ATCC 201157, CBS 776.97.

Pseudocercospora agharkarii (Chidd.) Crous & M. E. Palm, comb. nov. (Fig. 7)

≡ *Cercospora agharkarii* Chidd., *Curr. Sci.* **25**: 67 (1956).

Leaf spots epiphyllous, elongated to subcircular, sometimes

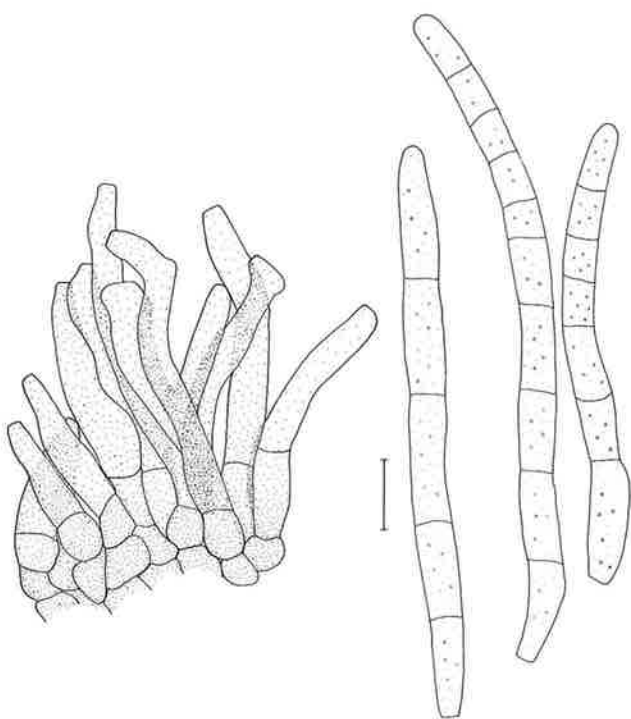


Fig. 7. Conidia and conidiophores of *Pseudocercospora agharkarii* (BPI 1103620). Bar = 10 μm .

confined by leaf veins, 1–5 mm diam., grey, with raised, dark brown borders, surrounded by inconspicuous margins. *Mycelium* internal, light brown, consisting of septate, branched, smooth hyphae, 2–3 μm wide. *Caespituli* fasciculate or sporodochial, epiphyllous, dark brown on leaves, up to 150 μm wide and 100 μm high. *Conidiophores* aggregated in loose to dense fascicles, arising from the upper cells of a light to medium brown stroma of up to 100 μm wide and 50 μm high; light brown, smooth, 0–1-septate, subcylindrical, straight or flexuous, 0–1 geniculate, unbranched, $10\text{--}45 \times 3\text{--}4 \mu\text{m}$. *Conidiogenous cells* terminal, unbranched, light brown, smooth, tapering or bluntly rounded at the apex, proliferating sympodially, $10\text{--}23 \times 3\text{--}4 \mu\text{m}$. *Conidia* solitary, olivaceous, smooth, finely guttulate, subcylindrical, straight to variously curved, apex obtuse, base obconically truncate, 3–11-septate, $(35\text{--})45\text{--}70\text{--}(95) \times (3\text{--})3.5\text{--}4.5\text{--}(5) \mu\text{m}$.

Holotype: India, Pollibetta, on leaves of *Grevillea robusta* Cunn. ex R. Br., G. Rangaswami & V. S. Seshadri, 7 Sep. 1968, BPI 1103620.

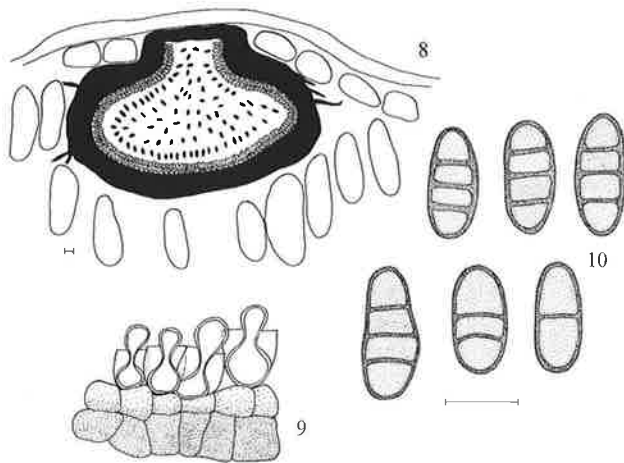
Only two other cercosporoid species are known from Proteaceae, namely *Cercostigmina protearum* (Cooke) U. Braun & Crous, with its three varieties, var. *protearum*, var. *leucadendri* (Cooke) U. Braun & Crous and var. *hakeae* U. Braun & Crous (Crous & Braun, 1996), and *Passalora protearum* Kalchbr. & Cooke. *Cercostigmina* U. Braun has chiefly percurrently proliferating conidiogenous cells, whereas those of *Pseudocercospora* Speg. proliferate sympodially and rarely also percurrently. The type of *P. protearum* could not be traced at Kew or B, but is described as having pale, 1-septate conidia, which measure $35\text{--}40 \times 7 \mu\text{m}$ (Cooke, 1890), so is clearly different from *P. agharkarii*. *Pseudocercospora agharkarii* is the only cercosporoid species known to occur on *Grevillea*.

Pseudohendersonia Crous & M. E. Palm, gen. nov.

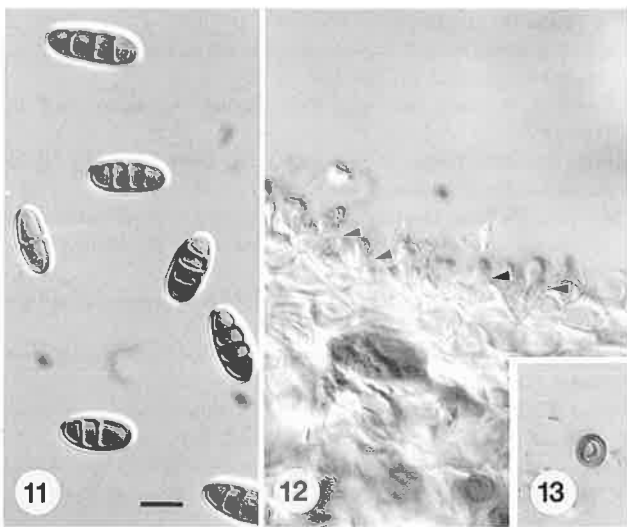
Maculis foliorum consociata. Conidiomata pycnidialia, solitaria, nigra, subcuticularia, demum erumpentia, globosa vel subglobosa, unilocularia; paries stratorum 3–4 textura angularis, mediobrunnea. Cellulae conidiogenae hyalinae, leaves, in strato interno parietis, cava tota tegentes, subcylindraceae, phialidicae, crassitie periclinali prominentissima. Conidia holoblastica, solitaria, sicca, late ellipsoidea, pallide brunnea ubi immatura, demum atrobrunnea ubi matura, utrinque obtusa, cicatrice dehiscendiae inconspicua, verruculosa, distoseptata.

Colonies associated with leaf spots. *Mycelium* internal, consisting of branched, septate, verruculose, medium brown hyphae. *Conidiomata* pycnidial, solitary, black, subcuticular, becoming erumpent, globose to subglobose, unilocular, with a central ostiole; wall consisting of several layers of medium brown *textura angularis*. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* hyaline, smooth, lining the inner layer of the wall, covering the whole cavity, subcylindrical to cupulate, phialidic (*sensu* Sutton, 1980), with successive conidia seceding at the same level, and very prominent periclinal thickening. *Conidia* holoblastic, solitary, dry, broadly ellipsoidal, light brown when immature, becoming dark brown at maturity, straight to slightly curved with a rounded apex and bluntly rounded base with an inconspicuous dehiscence scar, verruculose, (1–)3-distoseptate.

Type species: *Pseudohendersonia proteae* Crous & M. E. Palm.



Figs 8–10. *Pseudohendersonia proteae* (BPI 1107849). **Fig. 8.** Vertical section through a pycnidium. **Fig. 9.** Conidiogenous cells with prominent periclinal thickening. **Fig. 10.** Distoseptate conidia. Bar = 10 µm.



Figs 11–13. *Pseudohendersonia proteae* (BPI 1107849). **Fig. 11.** One to three-septate conidia. **Fig. 12.** Conidiogenous cells with prominent periclinal thickening (arrows). **Fig. 13.** Optical median section of a conidium, showing its double wall layer. Bar = 10 µm.

***Pseudohendersonia proteae* Crous & M. E. Palm, sp. nov.**
(Figs 8–13)

Conidiomata amphigena, pycnidialia, dispersa, nigra, subcuticularia, demum erumpentia, globosa vel subglobosa, unilocularia; paries stratorum 3–4 textura angularis, mediobrunnea usque 230 µm lata et 160 µm alta. Cellulae conidiogenae hyalinae, laeves, in strato interno parietis, cava tota tegentes, subcylindratae, phialidicae, crassitie periclinali prominentissima, 3.5–7.5 × 2.5–5 µm. Conidia holoblastica, solitaria, sicca, late ellipsoidea, pallide brunnea ubi immatura, demum atrobrunnea ubi matura, ad apicem obtusa, ad basem obtuse, recta ad vel leniter curvata, cum hilo inconspicua, verruculosa, (1–)3-distoseptata, (9–)10–12 × 4–5(–6) µm.

Lesions associated with tip blight symptoms of leaves, grey with a raised, red-brown margin. *Mycelium* internal, consisting of branched, septate, verruculose, medium brown hyphae, 2–3.5 µm wide. *Conidiomata* pycnidial, amphigenous, scattered, black, subcuticular, becoming erumpent, globose to subglobose, unilocular, up to 230 µm wide, 160 µm high, with

a central ostiole of up to 60 µm wide; wall up to 30 µm wide, consisting of 3–4 layers of medium brown *textura angularis*. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* hyaline, smooth, lining the inner layer of the wall, covering the whole cavity, subcylindrical to cupulate, phialidic (*sensu* Sutton, 1980), with successive conidia seceding at the same level, and very prominent periclinal thickening, 3–5–7.5 × 2.5–5 µm. *Conidia* holoblastic, solitary, dry, broadly ellipsoidal, light brown when immature, becoming dark brown at maturity, straight to slightly curved, rounded at both ends, with an inconspicuous dehiscence scar, verruculose, (1–)3-distoseptate, (9–)10–12 × 4–5(–6) µm.

Holotype: South Africa, on leaves of *Protea* sp., L. Schroeder, 15 Sep. 1986, BPI 1107849.

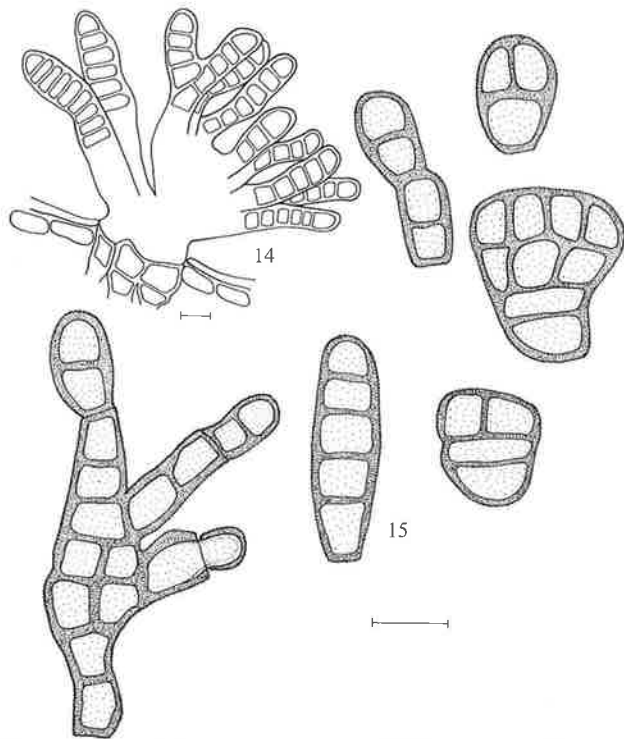
Additional specimen examined: South Africa, on leaves of a *Protea* sp., M. Luallen, 5 Nov. 1986, BPI 1107845.

Hendersonia is considered a *nomen rejiciendum* in favour of *Stagonospora* (Sutton, 1977). A number of species formerly accommodated in *Hendersonia* have been transferred to several similar genera (Sutton, 1980; Swart & Walker, 1988; Sutton & Dyko, 1989; Walker, Sutton & Pascoe, 1992; Ramaley, 1995; Crous *et al.*, 1997), some of which have been newly described. Several genera in this complex are pycnidial and produce pigmented conidia from phialidic conidiogenous cells (*sensu* Sutton, 1980), as does the fungus described here. None of these genera, however, combine the characteristics of this species, including the verruculose, distoseptate conidia produced from hyaline conidiogenous cells with prominent periclinal thickening. In *Parahendersonia* A. W. Ramaley the conidia are euseptate, while those of *Pseudohendersonia* are distoseptate. *Massariothea* Syd. and *Camarographium* Bubák have muriform conidia, but are distinct in that the former has branched paraphyses, and *Camarographium* has muriformly septate conidia (Sutton, 1980). Conidia and pycnidia of *Pseudohendersonia* also resemble those of *Sonderhenia* H. J. Swart & J. Walker. Conidiogenous cells of the latter, however, are different in being slightly pigmented and proliferating percurrently.

***Trimmatostroma protearum* Crous & M. E. Palm, sp. nov.**
(Figs 14, 15)

Sporodochia pulvinata, punctiformia, nigra, usque 250 µm diam. *Conidiophora* fasciculata, ex stromatibus emergentia, atrobrunnea vel nigra, crassitunicata, verruculosa, distoseptata, septis horizontalibus, verticalibus, obliquisque, 25–120 × 8–20 µm, subcylindratae, recta vel curvata, saepe in parte superiore ramulosa. Cellulae conidiogenae in conidiophoris incorporatae, terminales, atrobrunneae, crassitunicatae, verruculosae, 5–10 × 6–12 µm. Conidia solitaria vel in catenis ramulosis, forma variabili, multicellularia, saepe ad septa constricta, mediobrunnea, verruculosa, distoseptis horizontalibus uno ad aliquot, (12–(25–35)–45) × (7–)10–15(–25) µm.

Colonies amphigenous, black, punctiform, discrete, evenly distributed. *Sporodochia* pulvinate, black, up to 250 µm diam.; stromata in substomatal cavities, consisting of thick-walled, smooth, brown cells, 3–6 µm wide. *Mycelium* internal, consisting of branched, septate, verruculose, medium brown hyphae, 4–6 µm wide. *Conidiophores* fasciculate, emerging through stomata, dark brown to almost black, thick-walled,



Figs 14, 15. *Trimmatostroma proteae* (BPI 1107938). **Fig. 14.** Sporodochium on leaf surface. **Fig. 15.** Conidiophore and conidia with horizontal and muriform distosepta. Bar = 10 μ m.

verruculose, distoseptate, with horizontal, vertical and oblique septa, 25–120 \times 8–20 μ m, subcylindrical, straight to curved, frequently branched in the upper region. *Conidiogenous cells* integrated, terminal, dark brown, thick-walled, verruculose, 5–10 \times 6–12 μ m. *Conidia* single or in branched chains, variable in shape, multi-celled, frequently constricted at septa, medium brown, verruculose, with one to several horizontal distosepta; vertical and oblique distosepta frequently present (12–)25–35(–45) \times (7–)10–15(–25) μ m.

Holotype: South Africa, on dead leaf bracts of *Protea grandiceps* Tratt., L. Schroeder, 12 Sep. 1986, BPI 1107938.

Two species of *Trimmatostroma* are presently known to occur on *Protea*, *T. protearum* and *T. macowanii* (Sacc.) M. B. Ellis (1976). The latter produces shorter, narrower conidia (8–20 \times 5–9 μ m) than *T. protearum*, and has been collected in South Africa and Malawi (Ellis, 1976; Sutton, 1993).

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