Cercospora species and similar fungi of South Africa

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This contribution is the second of a series aimed at revising South African records of cercosporoid fungi. The present study describes six species, proposes one new combination, and reports one new record for South Africa. Two species of *Ramularia*, *R. greviae-occidentalis* and *R. zinniae* are described from *Grewia occidentalis* and *Zinnia peruviana* respectively. *Mycovellosiella dichondrae* is described from *Dichondra repens*, and *M. berkheyae-maritima* from *Berkheya maritima*, while *Fulvia berkheyae* is transferred to *Mycovellosiella*. *Pseudocercospora diospyri-lycioides* and *Paracercospora scolopiae* are described from *Diospyros lycioides* and *Scolopia zeyheri* respectively, and *Cercosporella hypoestis* noted as a new record on *Hypoestes forskalii*.

A recent examination of cercosporoid specimens lodged at the National Collection of Fungi in Pretoria (PREM), revealed several as yet undescribed or unreported species of *Cercospora* Fresen. and related genera. Because South African records of these fungi have not been revised since the study of Chupp & Doidge (1948), a systematic revision of specimens lodged at PREM was undertaken. In the first contribution of the present series (Crous & Braun, 1994), seven species and one variety were described and new combinations proposed for four

others. The present study describes an additional six species, proposes one new combination and reports one new record for South Africa.

Cercosporella hypoestis Hansf., *Proc. Linn. Soc. Lond.* **158**: 49 (1947).

Leaf spots not clearly defined, visible as irregular light brown areas on upper surface; grey-white on lower surface, 3–6 mm diam. *Mycelium* internal and external: primary hyphae smooth, hyaline, giving rise to minute stromata situated over stomata, 20–35 × 10–15 µm; secondary hyphae giving rise to single conidiophores. *Caespituli* hypophyllous, hyaline, 40–90 µm wide, 20–50 µm high. *Conidiophores* hyaline, smooth, arising singly from secondary mycelium or from minute stromata, fasciculate, arranged over stomata, 15–45 × 5–6 µm, 1–2-septate. *Conidiogenous cells* integrated, hyaline, smooth, proliferating sympodially, with thickened, refractive conidial scars, subcylindric to geniculate sinuous, 15–30 × 5–6 µm. *Conidia* hyaline, smooth, straight or gently curved, solitary, subcylindrical with a rounded apex and subtruncate base, 1–6-septate, 25–75 × 3–4 µm, with thickened, refractive hila (Fig. 1).

R.S.A.: Northern Transvaal, Louis Trichardt, Hanglip Forestry Station (entrance), *Hypoestes forskalii* (Acanthaceae), R. Y. Anelich, Apr. 1988, PREM 51107.

Cercosporella hypoestis is a new record for South Africa, being known from its type collection on *Hypoestes verticillaris* (L. f.) Soland. ex Roem. & Schult. collected in Zaire, Africa. Our collection of *C. hypoestis* is unusual for *Cercosporella*, in having secondary, superficial mycelium, that gives rise to solitary conidiophores. This peculiarity was neither mentioned in the original description of this fungus, nor by Deighton (1973).

Fig. 1. *Cercosporella hypoestis*. Stroma giving rise to hyaline conidiophores and conidia (PREM 51107; bar = 10 µm; P. Crous del.).

Fig. 2. *Mycovellosiella berkheyae*. Superficial mycelium forming conidiophores and conidiogenous cells that produce catenate conidia (PREM 6852, holotype; bar = 10 μ m; P. Crous del.).

***Mycovellosiella berkheyae* (Syd.) U. Braun & Crous comb. nov.**

Cladosporium berkheyae Syd., *Annls. mycol.* **12**: 267 (1914).

Fulvia berkheyae (Syd.) M. B. Ellis, *More Dematiaceous Hyphomycetes* p. 315 (1976).

Colonies hypophyllous, velvety, effuse, olivaceous brown. Mycelium internal and external: internal mycelium hyaline to olivaceous, 3–3.5 μ m wide; secondary mycelium arising from primary mycelium through stomata or from weakly developed stomata, smooth, medium brown, septate, branched, 5–9 μ m wide. Conidiophores fasciculate or solitary on secondary mycelium, simple or branched, often constricted at septa, smooth, medium brown, up to 300 μ m long, 4–9 μ m wide. Conidiogenous cells terminal, becoming intercalary, straight or geniculate-sinuous, indeterminate, regenerating enteroblastically via irregular, transverse annellations, smooth to finely verruculose, 15–45 $\times$ 5–10 μ m, sympodial, with slightly protuberant, thickened, refractive, widely spaced conidial scars, 2–3 μ m wide. Conidia solitary or catenate, obclavate to cylindrical or irregularly shaped, apices obtuse to broadly rounded, bases obconically truncate, with or without lateral branches, straight or curved, mostly constricted at septa, medium brown, smooth to finely verruculose, 15–60(–110) $\times$ 6–11 μ m, 1–5-septate, with slightly protuberant, thickened, refractive hila (Fig. 2).

R.S.A.: Natal, Cramond, *Berkheya* sp., J. B. Pole Evans, PREM 6852, ex Herb. Sydow at S (holotype).

Fulvia Cif. was originally seen as a synonym of *Cladosporium* by von Arx (1973), but later (von Arx, 1983), regarded as a synonym of *Mycovellosiella*, which he distinguished from *Cladosporium*. Deighton (1974), however, distinguished *Fulvia* from *Mycovellosiella* on the basis of the former having secondary mycelium which does not climb leaf hairs, and which is loosely fasciculate. Pons & Sutton (1988) stated that many species of *Mycovellosiella* do not climb leaf hairs, and form loose ropes of hyphae which is a characteristic of *Fulvia*. An examination of the type of *C. berkheyae* Syd. showed this taxon to fall in the *Mycovellosiella*/*Fulvia* complex. We are, however, in agreement with the observations of Pons & Sutton (1988), and therefore follow von Arx (1983), and reallocate this species to *Mycovellosiella*.

***Mycovellosiella berkheyae-maritimae* Crous & U. Braun sp. nov.**

Maculae amphigenae, 1–7 mm diam., orbiculares vel irregulares, brunneae, margine tenui atrobrunneo, elevato cinctae, interdum confluentes. Mycelium primarium immersum; mycelium secundarium superficiale: hyphae pallide brunneae, laeves, < 6 μ m latae; stromata epiphylla, brunnea, superficiale, 30–60 $\times$ 20–40 μ m. Caespituli epiphylli, 30–130 $\times$ 100–150 μ m. Conidiophora solitaria, ex mycelio secundario oriunda, vel fasciculata, pallide brunnea, laevia, recta, cylindrica vel geniculata-sinuosa, 2–6 septata, 40–100 $\times$ 4–5 μ m. Cellulae conidiogenae laeves, olivaceae, rectae, cylindricae vel geniculatae, 20–45 $\times$ 4–5 μ m. Cicatrices conidiales incrassatae, fuscae. Conidia solitaria, olivacea, recta vel curvata, interdum lateraliter ramosa, obclavata subcylindrica, ad apicem rotundata, basi obconice subtruncata, 35–130 $\times$ 4–5 μ m, hila incrassata, fusca.

R.S.A.: Natal, Donnybrook, Nxumeni Forestry Station, *Berkheya maritima* (Asteraceae), R. Y. Anelich, May 1988, PREM 51127, holotypus.

Leaf spots amphigenous, 1–7 mm diam., circular to irregular, brown on upper surface, with a raised, dark brown margin; light brown on lower surface, spots coalescing with age. Mycelium: primary hyphae internal; secondary mycelium external, light brown, smooth, up to 6 μ m diam., giving rise to brown, superficial stromata on the upper surface, 30–60 $\times$ 20–40 μ m, and single conidiophores on the lower leaf surface. Caespituli epiphyllous, situated over stromata, 30–130 μ m wide, 100–150 μ m high. Conidiophores occurring singly on secondary mycelium, or aggregated in fascicles situated on stromata, light brown, smooth, straight, cylindrical to geniculate sinuous, 2–6-septate, 40–100 $\times$ 4–5 μ m. Conidiogenous cells smooth, olivaceous, straight, cylindrical to geniculate, 20–45 $\times$ 4–5 μ m, with thickened, refractive conidial scars. Conidia single, olivaceous, smooth, straight or curved, forming lateral conidial branches, obclavate to subcylindrical with a rounded apex and obconically subtruncate base, 35–130 $\times$ 4–5 μ m, 3–10-septate, with thickened, refractive hila (Fig. 3).

Mycovellosiella berkheyae-maritimae is unusual in having well-developed fascicles. However, this has been reported for another species of *Mycovellosiella*, *M. concors* (Casp.) Deighton (1974). The conidia are also rather *Cercospora*-like and form singly, which is not very common in *Mycovellosiella*. *M. berkheyae-maritimae* is quite distinct from *M. berkheyae* (Syd.) U. Braun & Crous, which is known from a collection of *Berkheya* in South Africa, and has been treated above.

Fig. 3. *Mycovellosiella berkheyae-maritimae*. Stroma with fasciculate conidiophores and olivaceous conidia (PREM 51127, holotype; bar = 10 μ m; P. Crous del.).

***Mycovellosiella dichondrae* Crous & U. Braun sp. nov.**

Maculae saepe epiphyllae, orbiculares vel irregulares, 1–8 mm diam., brunneae. *Mycelium* primarium immersum: hyphae olivaceae, septatae, ramosae; mycelium secundarium superficiale: hyphae septatae, ramosae, brunneae, ca 3.5–5 μ m latae; stromata atrobrunnea, saepe leniter erumpentia, 15–40 $\times$ 10–20 μ m. *Caespituli* brunnei, saepe hypophylli, 30–60 $\times$ 50–100 μ m. *Conidiophora* solitaria, ex mycelio secundario oriunda, vel fasciculata, pallide brunnea, laevia, recta, subcylindrica vel geniculata-sinuosa, 1–3 septata, 15–75 $\times$ 3–4 μ m. *Cellulae conidiogenae* laeves, pallide brunneae, rectae, subcylindricae vel geniculatae-sinuosae, 12–25 $\times$ 3–4 μ m; cicatrices conidiales conspicuae, incrassatae, fuscae. *Conidia* catenata vel ramcatenata, olivacea, subcylindrica-fusiformia, laevia, 1–4 septata, 18–80 $\times$ 2–4 μ m, saepe lateraliter breve ramosa, hila incrassata, fusca.

R.S.A.: Northern Transvaal, Louis Trichardt, Clouds End Hotel, *Dichondra repens* (Convolvulaceae), R. Y. Anelich, Apr. 1988, PREM 51116, holotypus.

Leaf spots predominantly epiphyllous, circular to irregular, 1–8 mm diam., dark brown on upper surface, light brown below. *Mycelium* internal and external; internal hyphae olivaceous, septate, branched, giving rise to dark brown, somewhat erumpent stromata, 15–40 $\times$ 10–20 μ m; external, secondary mycelium septate, branched, brown, ca 3.5–5 μ m wide, forming solitary conidiophores. *Caespituli* brown, predominantly hypophyllous, 30–60 μ m wide, 50–100 μ m high. *Conidiophores* occurring singly on secondary mycelium, or aggregated in fascicles situated on stromata, light brown, smooth, straight, subcylindrical to geniculate sinuous, 1–3-septate, 15–75 $\times$ 3–4 μ m. *Conidiogenous cells* smooth, light brown, straight, subcylindrical to geniculate sinuous, 12–25 $\times$ 3–4 μ m, with thickened, refractive conidial scars. *Conidia* catenate, in simple or branched chains, olivaceous, subcylindrical-fusiform, smooth, 1–4-septate, 18–80 $\times$ 2–4 μ m, frequently also forming short lateral branches; hila thickened, refractive (Fig. 4).

Fig. 4. *Mycovellosiella dichondrae*. Conidiophores in fascicles and on secondary mycelium, giving rise to olivaceous, catenate conidia (PREM 51116, holotype; bar = 10 μ m; P. Crous del.).

Mycovellosiella dichondrae is a typical species of the genus characterized by having coloured conidia and fasciculate conidiophores originating from stromata, or single conidiophores forming separately on the brown, smooth, secondary mycelium. As far as we could establish, no other species of *Mycovellosiella* has thus far been described from this host.

***Paracercospora scolopiae* Crous & U. Braun sp. nov.**

Maculae amphigenae, atrobrunneae, angulares, per venas limitatae, 1–5 mm diam. *Mycelium* immersum; stromata minuta, brunnea, 20–30 $\times$ 10–15 μ m. *Caespituli* saepe epiphylli, brunnei, 20–40 $\times$ 20–70 μ m. *Conidiophora* olivacea, subcylindrica, recta vel leniter sinuosa, 20–70 $\times$ 3.5–5 μ m. *Cellulae conidiogenae* olivaceae, in conidiophoris incorporatae, terminales, sympodiales, 15–40 $\times$ 3.5–5 μ m; cicatrices conidiales satis conspicuae, margine tantum anguste et leniter incrassato. *Conidia* solitaria, pallide olivacea, recta vel valde curvata, subcylindrica, obclavata-acicularia, basi obconice subtruncata, ad apicem rotundata, laevia, 3–20 septata, 35–200 $\times$ 2–4 μ m, hila inconspicua, anguste incrassata, conidia saepe, aggregata, cirroidea.

R.S.A.: Northern Transvaal, Louis Trichardt, *Scolopia zeyheri* (Flacourtiaceae), R. Y. Anelich, Apr. 1988, PREM 51122, holotypus.

Leaf spots discrete, amphigenous, dark brown, angular, confined by leaf veins, 1–5 mm diam. *Mycelium* internal, giving rise to minute, brown stromata, 20–30 $\times$ 10–15 μ m. *Caespituli* predominantly hypophyllous, brown, 20–40 $\times$ 20–70 μ m. *Conidiophores* olivaceous, subcylindrical, straight or slightly sinuous, 20–70 $\times$ 3.5–5 μ m. *Conidiogenous cells* olivaceous, integrated, terminal, proliferating sympodially, 15–40 $\times$ 3.5–5 μ m, with conidial scars appearing as flattened, refractive, minutely thickened loci in the lateral plane, and as minute

Fig. 5. *Paracercospora scolopiae*. Fasciculate conidiophores and conidiogenous cells with minutely thickened loci, giving rise to olivaceous conidia (PREM 51122, holotype; bar = 10 µm; P. Crous del.).

circles with a slightly thickened and darkened rim when viewed from the front. Conidia solitary, pale olivaceous, straight to strongly curved, subcylindrical to obclavate-acicular, tapering from an obconically subtruncate base to a rounded apex, smooth, 3–20-septate, $35\text{--}200 \times 2\text{--}4$ µm, with inconspicuous, narrowly thickened conidial hila; aggregating as strings of white cirri on the leaf surface (Fig. 5).

Paracercospora scolopiae is characterized by its almost straight conidiophores without conspicuous geniculations, and the conidial scars that are flattened against the sides of the conidiogenous cells. The conidial scars are almost unthickened, but are refractive, conspicuous loci, seen as minute circles with a slight thickening and darkened rim. This type of conidial scar does not agree with that observed in *Cercospora*. The conidia also have narrowly thickened hila, which suggest that this collection is best accommodated in *Paracercospora* (Deighton, 1979). As far as we could establish, no related fungi are presently known from *Scolopia*.

***Pseudocercospora diospyri-lycioides* Crous & U. Braun sp. nov.**

Maculae amphigenae, orbiculares vel leniter angulares, brunneae, 1–5 mm latae, margine atrobrunneo cinctae. *Mycelium* saepe immersum; stromata substomatalia, $15\text{--}40 \times 10\text{--}15$ µm, olivacea. *Caespituli* amphigeni, modice brunnei, $25\text{--}50 \times 20\text{--}35$ µm. *Conidiophora* (= cellulae conidiogenae) pauca in fasciculum densum aggregata, per stoma emergentia, subcylindrica, ampulliformes vel leniter geniculata-sinuosa, $10\text{--}15 \times 2\text{--}3$ µm, pallide olivacea, monoblastica vel polyblastica, sympodiales; cicatrices conidiales inconspicuae, non incrassatae. *Conidia* solitaria, pallidissime olivacea, laevia, anguste cylindrica vel subcylindrica, ad apicem rotundata, basi subtruncate, 0–8 septata, $20\text{--}110 \times 1.5\text{--}2$ µm.

R.S.A.: Transvaal, Pretoria, Roodeplaat, Experimental Farm, Vegetable & Ornamental Research Institute, *Diospyros lycioides* var.

Fig. 6. *Pseudocercospora diospyri-lycioides*. Fasciculate conidiophores and conidia (PREM 51106, holotype; bar = 10 µm; P. Crous del.).

lycioides (Ebenaceae), E. J. van der Linde, Mar. 1988, PREM 51106, holotypus.

Leaf spots amphigenous, discrete, circular to slightly irregular, brown with a dark brown margin, 1–5 mm diam. *Mycelium* mostly internal, giving rise to olivaceous stromata situated over stomata, $15\text{--}40$ µm wide, $10\text{--}15$ µm high. *Caespituli* amphigenous, medium brown, $25\text{--}50$ µm wide, $20\text{--}35$ µm high. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* arising from stromata through stomata, in small and dense fascicles, subcylindrical, ampulliform to slightly geniculate-sinuosa, $10\text{--}15 \times 2\text{--}3$ µm, pale olivaceous, monoblastic to polyblastic, proliferating sympodially; conidial scars unthickened, inconspicuous. *Conidia* solitary, pale olivaceous, smooth, narrowly cylindrical to subcylindrical with a rounded apex and subtruncate base, 0–8-septate, $20\text{--}110 \times 1.5\text{--}2$ µm (Fig. 6).

Several *Pseudocercospora* species have been recorded from *Diospyros* L. in Asia (cf. Hsieh & Goh, 1990). *P. diospyri-lycioides* is close to *P. diospyri-erianthae* Goh & Hsieh, but differs in having smaller conidiophore fascicles and narrower conidia. *P. kaki* Goh & W. H. Hsieh possesses very large stromata with numerous conidiophores and wider, subcylindrical conidia. *P. diospyri-morrisonianae* Goh & W. H. Hsieh and *P. diospyricola* Goh & W. H. Hsieh are distinguished by superficial mycelium with secondary conidiophores.

***Ramularia grewiae-occidentalis* Crous & U. Braun sp. nov.**

Maculae amphigenae, suborbiculares vel irregulares, 1–15 mm diam., dispersae, brunneae, margine atrobrunneo cinctae. *Mycelium* primum immersum. *Mycelium* secundarium superficiale: hyphae hyalinae, laeviae, < 2 µm latae. *Conidiophora* (= cellulae conidiogenae) solitaria, ex mycelio secundario oriunda, hyalina, laevia, recta, subcylindrica vel geniculata-sinuosa, $10\text{--}15 \times 2.5\text{--}4$ µm; cicatrices conidiales conspicuae, incrassatae, fuscae. *Conidia* catenata, interdum ramicatenata, hyalina, laevia, subcylindrica-fusiformia, $5\text{--}25 \times 1.5\text{--}2$ µm, 0–3 septata, hila leniter incrassata, fusca.

R.S.A.: Natal, Donnybrook, Nxumeni Forestry Station, *Grewia occidentalis* var. *occidentalis* (Tiliaceae), R. Y. Anelich, May 1988, PREM 51123, holotypus.

Leaf spots amphigenous, discrete, circular to irregular, brown with a dark brown margin, evenly dispersed, 1–15 mm diam. *Mycelium*: primary hyphae internal; secondary mycelium external, hyaline, smooth, up to 2 µm wide, forming solitary conidiophores. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* hyaline, smooth, solitary, forming on secondary mycelium, integrated, elongating sympodially, straight, subcylindrical to geniculate sinuous, $10\text{--}15 \times 2.5\text{--}4$ µm with refractive, thickened scars. *Conidia* catenate, in simple or branched chains, hyaline, smooth, subcylindrical-fusiform, $5\text{--}25 \times 1.5\text{--}2$ µm, 0–3-septate, with refractive, slightly thickened hila (Fig. 7).

Ramularia grewiae-occidentalis is presently the only species of the genus known to occur on *Grewia*. It is characterized by having hyaline structures and catenate conidia with thickened, darkened scars. The superficial, secondary mycelium is not uncommon of *Ramularia*. Although Deighton (1974) proposed to include such species in *Mycovellosiella*, the latter genus should be confined to taxa with coloured structures (cf. Braun, 1990). *R. grewiae-occidentalis* can be distinguished from *R. grewiae* Lacy & Thirum. (= *Mycovellosiella grewiae* (Srivast. & Mehta) Deighton), which has solitary, large, wide, obclavate-fusiform conidia (Thirumalachar & Lacy, 1951; Deighton, 1979).

Ramularia zinniae Crous & U. Braun sp. nov.

Maculae amphigenae, orbiculares, 3–7 mm diam., pallide brunneae vel griseae, margine atrobrunnei cinctae. *Mycelium* immersum; stromata substomatalia vel intraepidermalia, 10–30 µm diam., hyalina, saepe leniter erumpentia. *Caespituli* saepe hypophylli, $10\text{--}30 \times 10\text{--}20$ µm. *Conidiophora* (saepe = cellulae conidiogenae) hyalina, laxe fasciculata, per stoma emergentia vel per cuticulam erumpentia. *Cellulae conidiogenae* is conidiophoris incorporatae, hyalinae, sympodiales, rectae, subcylindricae vel geniculatae-sinuosae, $5\text{--}20 \times 2\text{--}3$ µm; cicatrices conidiales conspicuae, minutae, leniter incrassatae, fuscae. *Conidia* hyalina, catenata, raro ramicatenata, subcylindrica-fusiformia, $5\text{--}25\text{--}(30) \times 1\text{--}2\text{--}(2.5)$ µm, laevia, 0–1 septata, hila lenissime incrassata, fusca.

R.S.A.: Northern Transvaal, Louis Trichardt, Hanglip Forestry Station, *Zinnia peruviana* (Asteraceae), R. Y. Anelich, Apr. 1988, PREM 51130, holotypus.

Leaf spots amphigenous, discrete, circular, 3–7 mm diam., light brown to grey, surrounded by a dark brown margin. *Mycelium* internal, forming loose hyphal aggregations; stromata substomatal and intraepidermal (also in the surrounding cells of the stomatal openings), 10–30 µm diam., colourless, often slightly erumpent. *Caespituli* predominantly hypophyllous, 10–30 µm wide, 10–20 µm high. *Conidiophores* hyaline, arranged in loose fascicles, arising from stomata, or erumpent through the cuticle of epidermal cells, mostly reduced to conidiogenous cells. *Conidiogenous cells* hyaline, integrated, elongating sympodially, straight and subcylindrical to geniculate sinuous, $5\text{--}20 \times 2\text{--}3$ µm, with minute refractive, slightly thickened scars. *Conidia* hyaline, catenate, in simple, seldomly branched chains, subcylindrical-fusiform, $5\text{--}25\text{--}(30)$

Fig. 7. *Ramularia grewiae-occidentalis*. Hyaline, fasciculate conidiophores, and conidia with thickened hila (PREM 51123, holotype; bar = 10 µm; P. Crous del.).

Fig. 8. *Ramularia zinniae*. Solitary or loosely fasciculate conidiophores, giving rise to hyaline, catenate conidia (PREM 51130, holotype; bar = 10 µm; P. Crous del.).

$\times 1\text{--}2\text{--}(2.5)$ µm, smooth, 0–1-septate, with minute, thickened, refractive hila (Fig. 8).

Ramularia zinniae is the only species of *Ramularia* presently known from this host. It is also a typical *Ramularia* species with simple or branched, conidial chains. Structures also vary from being hyaline to having a slight greenish tinge. The size and thickening of the conidial scars in *Ramularia* depend directly on the width of the conidia and their hila. Although the conidial scars and hila of *R. zinniae* are minute, they are still conspicuous.

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