

Colletogloeopsis, a new coelomycete genus to accommodate anamorphs of two species of *Mycosphaerella* on *Eucalyptus*

P.W. Crous and M.J. Wingfield

Abstract: Species in *Colletogloeopsis* are characterized by having acervular conidiomata, and brown, verruculose, thick-walled, aseptate conidia that are formed on brown, verruculose conidiogenous cells that proliferate sympodially or percurrently. *Colletogloeum nubilosum*, the anamorph of *Mycosphaerella cryptica*, is transferred to *Colletogloeopsis*. *Colletogloeopsis molleriana* is described for the anamorph of *Mycosphaerella molleriana*, formed from single ascospore isolations obtained from collections of *Eucalyptus globulus* leaves from Portugal and California, United States. *Mycosphaerella molleriana* is redescribed and distinguished from *Mycosphaerella nubilosa*, which was earlier regarded to be synonymous with the former.

Key words: *Colletogloeum*, *Mycosphaerella* leaf blotch, systematics.

Résumé : Les espèces du *Colletogloeopsis* se caractérisent par des conidiomata acervulés, ainsi que des conidies brunes, verruqueuses et aseptées qui se forment sur des cellules conidiogènes brunes et verruqueuses qui prolifèrent de façon sympodiale ou percurrente. Les auteurs transfèrent le *Colletogloeum nubilosum*, anamorphe du *Mycosphaerella cryptica*, au *Colletogloeopsis*. Ils décrivent le *Colletogloeopsis molleriana* comme anamorphe du *Mycosphaerella molleriana*; il est formé d'isolats à ascospores simples obtenus à partir d'une collection sur feuilles de l'*Eucalyptus globulus*, provenant du Portugal et de la Californie aux États-Unis. Ils redécrivent le *M. molleriana* pour le distinguer du *Mycosphaerella nubilosa*, qui a été auparavant considéré comme synonyme du premier.

Mots clés : *Colletogloeum*, tache foliaire du *Mycosphaerellea*, systématique.

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Introduction

Several species of *Mycosphaerella* Johanson have been associated with *Mycosphaerella* leaf blotch (MLB) disease of *Eucalyptus* spp. both in Australia, where these trees are native, and elsewhere where they are commercially propagated (Carnegie et al. 1994; Crous and Wingfield 1996). One of the most often cited *Mycosphaerella* spp. occurring on eucalypts is *M. molleriana* (Thüm.) Lindau. Although this species has been associated with MLB on many species of *Eucalyptus* from several countries (Crous et al. 1991, 1995b; Carnegie and Keane 1994), it appears that most records are not conspecific with the type of *M. molleriana* (Crous and Alfenas 1995; Crous and Wingfield 1996). *Mycosphaerella molleriana*, which is similar to *Mycosphaerella nubilosa* (Cooke) Hansf. and *Mycosphaerella cryptica* (Cooke) Hansf., was described as a species of *Sphaerella* from *Eucalyptus globulus* Labill. in Portugal by Von Thümen (1881). Based on leaf symptoms, pseudothecial

distribution, and general morphology, Crous et al. (1991) considered *M. nubilosa* to be a synonym of *M. molleriana*, but distinct from *M. cryptica*. In recent years, we collected several fresh field specimens that enabled us to study cultural features and mode of ascospore germination. Based on these studies, we concluded that our earlier interpretation (Crous et al. 1991) of *M. molleriana* was incorrect, and that it includes several distinct taxa (Crous and Wingfield 1996). Because *M. molleriana* was the first species of *Mycosphaerella* to be described from *Eucalyptus* (Corlett 1991) and this tree genus has become increasingly important to the international paper and pulp industry, it is imperative that the taxonomy of this frequently cited species of *Mycosphaerella* be clarified.

Sphaerella nubilosa Cooke was originally described from eucalypt leaves in Australia (Cooke 1893), and later transferred to *Mycosphaerella* (Hansford 1957). *Colletogloeum nubilosum* Ganap. & Corbin was described as the anamorph of *M. nubilosa* (Cooke) Hansf. (Ganapathi and Corbin 1979). This anamorph—teleomorph connection was incorrect, however, because *Colletogloeum nubilosum* was later shown to be the anamorph of *M. cryptica* (Park and Keane 1982). In the description of *Colletogloeum nubilosum*, Ganapathi and Corbin (1979) noted that there were several morphological features that were inconsistent with the type species of *Colletogloeum* Petr., or with other species of the genus. In the present study, *Colletogloeum*-like anamorphs were observed in cultures derived from single ascospores obtained

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from *Eucalyptus* leaves with symptoms morphologically similar to the type of *M. molleriana*.

The coelomycete genus *Colletogloeum* has been linked to two distinct loculoascomycete genera, *Coccoidella* Höhn. and *Mycosphaerella*. However, neither of the anamorphs linked to these teleomorphs appear to be congeneric with the type species, *Colletogloeum sissoo* (Syd.) B. Sutton, which has hyaline, 1- to 4-septate, smooth conidia. *Colletogloeum perseae* Sivan. (teleomorph: *Coccoidella perseae* Sivan.) is distinct from *Colletogloeum sissoo* by having rostrate conidia with a long, apical, branched or unbranched appendage (Sivanesan 1987). *Colletogloeum nubilosum* (teleomorph: *Mycosphaerella cryptica*) differs from *Colletogloeum sissoo* in producing aseptate, brown, verruculose conidia that are formed on brown, verruculose conidiogenous cells that proliferate percurrently or sympodially. In a recent revision of species complexes within *Colletogloeum*, Morgan-Jones and Phelps (1995) noted that this genus is heterogenous, and that features such as conidium morphology may have to be examined more closely to accurately define taxonomic groups.

The anamorph obtained for *M. molleriana* in the present study is morphologically similar to *Colletogloeum nubilosum*. The two taxa form a group distinct from *Colletogloeum* which is characterized by the production of brown, verruculose, thick-walled, aseptate conidia, from sympodially or percurrently proliferating brown, verruculose, conidiogenous cells. To determine the appropriate generic placement, several other generic names were considered. These taxa cannot be accommodated in *Lecanostictopsis* B. Sutton & Crous, which includes species with verruculose to tuberculate conidiogenous cells, conidiophores, and conidia, and a dark brown conidioma consisting of dense hyphal elements. They differ from species of *Lecanosticta* Syd. because of their aseptate conidia, and sympodial as well as percurrent proliferation. Similarly, they are distinguished from species of *Ahmadia* Syd. by having subepidermal conidiomata, and from *Marssonina* Magnus and *Cryptocline* Petr. by having medium brown, verruculose, conidiogenous cells and conidia. None of these genera share all the characteristics of the *Colletogloeum*-like anamorphs of *Mycosphaerella*, and they differ in either conidial or conidiophore morphology, pigmentation, or mode of conidiogenesis. The *Colletogloeum*-like fungi from *Eucalyptus* appear to represent a group intermediate between *Colletogloeum* and *Lecanostictopsis*. For these reasons, it is our opinion that these two species are best accommodated in a separate genus, which is described here.

Materials and methods

Leaves of *E. globulus* with MLB symptoms were collected from plantations in southern Portugal and from shade-tree plantings near Berkeley, California. Leaves were tightly packed between sheets of paper and transported to the laboratory. Lesions were excised from leaves, and single ascospores were placed on 2% malt extract agar (Biolab Diagnostics, Midrand, JHB, South Africa) (MEA) as described in Crous et al. (1991). Germinating ascospores were examined after 24 h, illustrated, then transferred to MEA. Cultures were incubated for 2 weeks at 25°C in the dark, then subcultured onto divided plates with one half containing carnation-leaf agar (CLA) (Crous et al. 1992) and the other MEA, incubated at 25°C under continuous near-ultraviolet light. Linear growth on agar for each culture was determined after 1 month as explained in Crous

and Wingfield (1996). Colony colors (top and bottom) were determined using the color charts of Rayner (1970). All measurements were made of fungal structures mounted in lactophenol. Thirty measurements of each structure were taken, whenever sufficient material was available; extremes are given in parentheses.

Taxonomy

Colletogloeopsis Crous et M.J. Wingf. gen.nov.

Mycelium internum et externum, pallide ad mediobrunneum, septatum, ramosum, laevigatum. Acervuli atrobrunnei ad atrii, subcuticulares, erumpentes. Conidiogenae cellulae doliiformes ad subcylindraceae vel irregulares, parietibus tennibus, brunneae, verruculosae, proliferationibus sympodialibus vel compluriente enteroblasticis et percurrentibus. Conidia solitaria, aseptata, mediobrunnea, verruculosa, subcylindracea ad ellipsoidea, recta ad parum curvata; apex obtusus, basis truncata, margine fimbriato. Status teleomorphicus *Mycosphaerella*.

TYPE SPECIES: *Colletogloeopsis nubilosum* (Ganap. et Corbin) Crous et M.J. Wingf. comb.nov.

Mycelium internal and external, light to medium brown, septate, branched, smooth. Acervuli dark brown to black, subcuticular, erumpent. Conidiogenous cells arising from upper cells of the stroma, doliiform to subcylindrical or irregular, thick-walled, brown, verruculose, proliferating sympodially or several times enteroblastically and percurrently. Conidia single, aseptate, medium brown, verruculose, subcylindrical to ellipsoidal, straight to slightly curved, apex obtuse, base truncate with a marginal frill, occasionally with a lateral protuberance that can develop into a secondary conidium. Teleomorph *Mycosphaerella*.

Colletogloeopsis nubilosum (Ganap. et Corbin) Crous et M.J. Wingf. comb.nov. Fig. 1
≡ *Colletogloeum nubilosum* Ganap. & Corbin, Trans. Br. Mycol. Soc. 72: 237. 1979 (basionym)

TELEOMORPH: *Mycosphaerella cryptica* (Cooke) Hansf., Proc. Linn. Soc. N.S.W. 81: 35, 1956

Mycelium internal and external, light to medium brown, septate, branched, smooth, hyphae 3–5 µm wide. Acervuli amphigenous, dark brown to black, subcuticular, erumpent, up to 150 µm wide and 100–200 µm high. Conidiogenous cells arising from upper cells of the stroma, doliiform to subcylindrical or irregular, 5–10 × 4–7 µm, thick-walled, brown, verruculose, proliferating sympodially or 1–4 times enteroblastically and percurrently. Conidia single, aseptate, medium brown, verruculose, subcylindrical to ellipsoidal, straight to slightly curved, apex obtuse, base truncate with a marginal frill, (8.5–)10–15(–18) × 4–5(–6) µm, occasionally with a lateral protuberance that can develop into a secondary conidium.

HOLOTYPE: NEW ZEALAND: Auckland, leaves of *Eucalyptus delegatensis*, A. Ganapathi, April 1977, PDD 37677.

HOSTS: *Eucalyptus agglomerata*, *E. baxteri*, *E. bicostata*, *E. blakelyi*, *E. bosistoana*, *E. botryoides*, *E. bridgesiana*, *E. brookeriana*, *E. camaldulensis*, *E. camphora*, *E. cladocalyx*, *E. consideniana*, *E. cypellocarpa*, *E. dalrympleana*, *E. delegatensis*, *E. dendromorpha*, *E. diversicolor*, *E. dives*,

