Curvicladium gen. nov., a new hyphomycete genus from French Guiana

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Abstract: A *Cylindrocladium*-like hyphomycete was isolated from seeds and leaves of an unknown angiosperm in French Guiana. Based on the sporodochial arrangement of its colorless conidiophores, its multiple stipe extensions that terminate in prominently curved, verruculose, thick-walled, light brown apical cells, as well as its septate, cylindrical conidia, a new genus, *Curvicladium*, is proposed to accommodate these collections.

Key Words: *Cylindrocladium*, hyphomycetes, Hypocreales, systematics

INTRODUCTION

Two collections of a *Cylindrocladium*-like hyphomycete with colorless conidiomata and cylindrical, 1-septate conidia were recently obtained from seeds and leaf litter in French Guiana. Several hyphomycete genera have been described as being morphologically similar, but yet distinct from *Cylindrocladium* Morgan. These include *Cylindrocladiella* Boesew., *Gliocladiopsis* Saksena, (Crous and Wingfield, 1993), *Falcocladium* Silveira et al. (Crous et al., 1994), and *Xenocylindrocladium* Decock et al. (Decock et al., 1997). In a recent checklist published by Courtecuisse et al. (1996) dealing with the known fungi from French Guiana, numerous hypocrealean fungi were listed. Examples of the genera dealt with in this study, however, have apparently been poorly collected from this area, and only two collections of *Calonectria* De Not. (with *Cylindrocladium* anamorphs) are listed. As we believe our fungus to be distinct from similar genera with cylindrical conidia and stipe extensions, a new genus is therefore proposed for it.

MATERIALS AND METHODS

The *Cylindrocladium*-like fungus was isolated as single conidia under a stereo microscope immediately after collection. Isolates were cultured on 2% malt extract agar (MEA) (Oxoid), plated onto carnation-leaf agar (CLA) (Crous et al., 1992), incubated at 25 C under near-ultraviolet light, and examined after 7 d. Only material occurring on carnation leaves was examined. Mounts were prepared in lactophenol, and measurements made at 1000 × magnification. Wherever possible, each measurement represents at least 30 observations, and extremes are given in parentheses.

Scanning electron microscopy (SEM) was used to observe the nature of the stipes and sporodochia. Specimens were flash frozen (–212 C) in liquid nitrogen under vacuum for cryo-SEM, transferred to the preparation chamber, and then to the SEM chamber where the frozen samples were sublimated (–80 C) to remove ice particles. Samples were sputter coated with gold in the preparation chamber for 75 s under 1.2 KV at –170 C. Specimens were viewed under 5 KV at –188 C with a Phillips XL20 scanning electron microscope with an Oxford cryosystem.

TAXONOMY

Curvicladium Decock et P.W. Crous, gen. nov.

Conidiomata sporodochialis vel synnematalia vel penicillata, e stromata chlamydosporaris fuscis crassitunicatae extruenda. Conidiophora stipite basale laeve usque verrucosa, crassitunicata, leviter usque satis brunnea; apparatu conidiogeno ac numerosis extensionibus basi 1-septatis apicaque 1(–2)-septatis instructa. Stipiti extensiones sine vesiculis, cellula apicale crassitunicata, verrucosae, leviter coloratae, valde curvatae, in apice acuto attenuatae. Conidiophori rami hyalina, laeves, cylindrici, recti vel laeviter curvati. Phialides hyalinae, laeves, doliiformes vel reniformes an cylindratae, apice paucae et periclinale incrassatae, collo effuso, aperto quasiinconspicuo. Conidia cylindrica, septata, sine absicionis cicatibus visilibus, in muco incolorate agglomerata. Chlamydosporae brunnea, crassitunicatae, intercalares, saepe in microsclerotius conglomeratae.

Etymology. In reference to the curved apical cells on its sterile stipe elongations.

Accepted for publication September 19, 1997

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Conidiomata sporodochial or synnematal, consisting of numerous penicillate conidiophores arising from a stroma of brown, thick-walled chlamydospores. Conidiophores comprising a thick-walled, smooth to finely verruculose, septate, medium to light brown basal stipe, a conidiogenous apparatus, and several sterile stipe elongations that have 1(–2) apical and one basal septum; stipe elongations aviculate; apical cell thick-walled, verruculose, light brown, prominently curved, tapering toward a bluntly rounded acute apex. Conidiophore branches colorless, smooth, subcylindrical, straight to slightly curved. Phialides colorless, smooth, doliiform to reniform or subcylindrical, apex with minute periclinal thickening, collarete inconspicuous, flared. Conidia cylindrical, septate, lacking a visible abscission scar, held in heads of colorless slime. Chlamydospores intercalary, often aggregating to form microsclerotia.

Type species. Curviciadium cigneum C. Decock & P.W. Crous.

Curviciadium cigneum C. Decock et P.W. Crous, sp. nov. FIGS. 1–12

Conidiomata sporodochialis vel synnematalia an penicillata, multa e stromata chlamydosporis fuscis crassitunicatae in culturis CLA extruenda. Conidiophora sub conidiogena apparatus stipitibus crassitunicatae, laevibus usque parum verruculosae, leviter usque satis brunneis 2–5-septatis, 50–100 μm longis, 3–5 μm latis. Stipitis extensiones steriles 1–4, sine vesiculis 110–200 μm longae, 1(–2) apicale et 1 basale septis munitae leviter usque valde verruculosae, dilute brunnae, valde curvatae 50–90 μm longae, in apice obtuse acuto attenuatae. Conidiophori rami incolorati, laeves, cylindracei, recti vel laeve incurvati, 0(–1)-septati, ramulis primariis 15–30 $\times$ 4–5 μm , 1–4 ramulos secundarios 8–22 $\times$ 4–5 μm parientibus, ipsi 1–3 ramulos tertiarios 10–15 $\times$ 3–4 μm parientes. Phialides hyalinae, laeves, doliiformes vel reniformes an cylindraceae, 8–18 $\times$ 3–5 μm , apice minute periclinaleque incrassatae, collo apperto, effuso, quasi inconspicuis. Conidia cylindrica, (28–)33–36(–38) $\times$ 2.5–3 μm , 1-septata, sine absicionis cicatris visibilibus, in muco incolorate agglomerata. Chlamydosporae globosae vel ellipsoideae, satis brunnae, crassitunicatae, paucae numerosae, 6–25 $\times$ 7–12 μm , saepe in microsclerotiis conglomeratae.

Etymology. In reference to the apical cell, curved like a swan neck.

Teleomorph. Unknown.

Conidiomata sporodochial or synnematal, consisting of numerous penicillate conidiophores arising from a stroma of brown, thick-walled chlamydospores when cultured on CLA. Conidiophores comprising a

thick-walled, smooth to finely verruculose, medium to light brown basal stipe, 2–5-septate, 50–100 μm long, 3–5 μm wide below the conidiogenous apparatus, and 1–4 sterile stipe elongations, 110–200 μm long, that have 1(–2) apical and one basal septum; stipe elongations aviculate, becoming swollen below the apical septum, 6–9 μm wide; apical cell thick-walled, verruculose, light brown, prominently curved, 50–90 μm long, rarely becoming 1-septate, tapering toward a bluntly rounded acute apex. Conidiophore branches colorless, smooth, subcylindrical, straight to slightly curved, 0(–1)-septate; primary branches 15–30 $\times$ 4–5 μm , each producing 1–4 secondary branches, 8–22 $\times$ 4–5 μm , each of which in turn produces 1–3 tertiary branches, 10–15 $\times$ 3–4 μm . Phialides colorless, smooth, doliiform to reniform or subcylindrical, 8–18 $\times$ 3–5 μm , apex with minute periclinal thickening, collarete inconspicuous, flared. Conidia cylindrical, (28–)33–36(–38) $\times$ 2.5–3 μm , 1-septate, lacking a visible abscission scar, held in heads of colorless slime. Chlamydospores globose to elongate ellipsoidal, medium brown, thick-walled, formed in moderate numbers, 6–25 μm long, 7–12 μm wide, often aggregating to form microsclerotia.

Cultures. Colonies reaching 25.7 mm diam on MEA after 6 d in the dark at 25 C, with the reverse becoming umber (13'i; Rayner, 1970); chlamydospores sparse to moderate in number, with sparse aerial mycelium.

Substrate. Decaying angiospermous leaves and seeds.

Known distribution. French Guiana.

HOLOTYPE. FRENCH GUIANA. Matoury, first part of the Lamirande trail, on decaying leaf of unknown angiosperm, 23 Jan. 1997, *C. Decock* FG2240, specimen MUCL 40269 (culture ex-type MUCL 40269b, STE-U 1595).

Additional specimen examined. FRENCH GUIANA. Matoury, first part of the Lamirande trail, on decaying seed of unknown angiosperm, 20 Jan. 1997, *C. Decock* FG2158, specimen MUCL 40268 (culture MUCL 40268b, STE-U 1594).

The genus *Curviciadium* is distinguished from *Cylindrocladium* by having conidiophores that are arranged in sporodochia, and single to multiple stipe extensions that have one basal and 1(–2) apical septa. Furthermore, the apical cells are thick-walled, verruculose, light brown and prominently curved. Although *C. avesiculatum* Gill et al. also is known to have thick-walled, faintly pigmented, aviculate stipe extensions, these are smooth, multi-septate, and occur on separate, penicillate conidiophores (Crous and Wingfield, 1994). Species of *Sarcopodium* Ehrenb. have pigmented stipe extensions, but ellipsoid-

FIGS. 1–5. *Curvicladium cigneum* (MUCL 40269). 1. Stroma giving rise to a sporodochium of conidiophores. 2. Conidiophores with prominently curved stipe extensions. 3. Cylindrical 1-septate conidia. 4. Conidiophore with three immature stipe extensions. 5. Chlamydospores. Bar = 10 μ m.

FIGS. 6–8. *Curvcladium cigneum* (MUCL 40269). 6. Sporodochial arrangement of conidiophores. 7. Conidiophore with a prominently curved stipe extension. 8. Stipe extension with swollen cell (arrowed) below the apical septum. Bar = 10 μ m.

al conidia (Sutton, 1981), and are thus also distinct from *Curvcladium*. The genus *Cylindrocladiella* is known to have conidiophores that have one basal septum in their stipe extensions. As in *Cylindrocladium*, conidiophores in *Cylindrocladiella* occur separately on the mycelium, and have one stipe extension per conidiophore. Multiple stipe extensions are characteristic of *Falcocladium*, as is the frequent sporodochial to synnematal arrangement of conidiophores. *Falcocladium* and *Thozetella* Kuntze can be easily distinguished from *Curvcladium* by the absence of curved, verruculose, light brown apical cells, and by having falcate, appendaged, rather than cylindrical, non-appendaged conidia. *Gliocladiopsis* Saksena has cylindrical conidia and penicillate conidiophores that may be arranged in sporodochia, but again these lack stipe extensions. *Xenocylindrocladium* has thin-walled, smooth stipe extensions that are sinuous to coiled at their aversiculate apices. *Septomyrothecium* Matsush. has sporodochia consisting of penicillate conidiophores that sometimes produce stipe extensions, but has conidia accumulating in a green-

ish-black mucoid mass (Matsushima, 1971), and is thus also distinct from *Curvcladium*. Contrary to the wider concept of *Cylindrocladium* proposed by Carmichael et al. (1980) and Peerally (1991), subsequent research found genera such as *Cylindrocladiella* and *Gliocladiopsis* to be distinct (Crous and Wingfield, 1993; Crous and Peerally, 1996). Furthermore, Rossman (1979, 1983) also restricted *Calonectria* De Not. to species having *Cylindrocladium* anamorphs, while Samuels et al. (1991) placed the teleomorphs of *Cylindrocladiella* in *Nectria* (Fr.) Fr. subgenus *Dialonectria* Sacc. The recent description of three new morphologically similar, yet distinct anamorph genera from South America, namely *Falcocladium* from Brazil (Crous et al., 1994, 1997), *Xenocylindrocladium* from Ecuador (Decock et al., 1997), and *Curvcladium* from French Guiana, suggests that this generic complex needs to be more intensively collected from tropical regions of the world, and that their teleomorphs, when found, would further elucidate their relationship to other genera in the Hypocreales.

FIGS. 9–12. Scanning electron micrographs of *Curvocladium cigneum* (MUCL 40269). 9. Sporodochial arrangement of conidiophores. 10. Conidiophores with swollen, developing stipe extensions (arrowed). 11, 12. Curved, verruculose stipe extensions showing swelling below the apical septum (arrowed).

KEY TO *CYLINDROCLADIUM*-LIKE GENERA WITH
PENICILLATE CONIDIOPHORES

1. Conidiophores penicillate, separate	8	5. Stipe extensions without apical vesicles	<i>Thozetella</i>
1. Conidiophores penicillate, arranged in sporodochia or synnemata	2	5. Stipe extensions with apical vesicles	<i>Falcocladium</i>
2. Conidia not cylindrical	3	6. Conidial masses greenish-black	<i>Septomyrothecium</i>
2. Conidia cylindrical	4	6. Conidial masses hyaline	7
3. Conidia ellipsoidal, non-appendaged; stipe extensions pigmented		7. Stipe extensions multi-septate, spirally twisted, colorless, smooth	<i>Xenocylindrocladium</i>
3. Conidia falcate and appendaged; stipe extensions colorless	5	7. Stipe extensions with one apical and basal septum, apical cell curved, pigmented, verruculose	
4. Conidiophores without stipe extensions			<i>Curvocladium</i>
	<i>Gliocladiopsis</i>	8. Stipe extensions aseptate, thick-walled; conidia shorter than 25 µm, arranged in irregular packages; phialide collarettes convergent	
4. Conidiophores with stipe extensions	6		<i>Cylindrocladiella</i>
		8. Stipe extensions septate, thin-walled; conidia long	

ger than 30 µm, arranged in cylindrical packages; phialide collarettes divergent *Cylindrocladium*

ACKNOWLEDGMENTS

The first author sincerely thanks the Ministère de l'Agriculture et de la Pêche, Paris, for granting the necessary collection and importation permits. The Service fédéral des affaires Techniques, Scientifiques et Culturelles (SSTC) is thanked for financial support (contract BCCM 94-98/10/003), and J. De Brabandere, coordinator of the Belgian Co-Ordinated Collection of Micro-organisms (BCCM) for continuously supporting the MUCL Culture Collection. J.M. Seng from Biotransfer, Paris, France, is also thanked for partly sponsoring the trip to French Guiana. Dr. Didelot and Mrs Goubert (Service de la Protection des Végétaux, Cayenne, French Guiana), and Mrs. M. Henry de Frahan are thanked for their assistance, and prof. C. Evrard (UCL, Bota) for the Latin translation.

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