

Curviciadium 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, *Curviciadium*, 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

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

Conidiomata sporodochialis vel synnematalia vel penicillata, e stromata chlamydosporaris fuscis crassitunicatae extruente. 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 pauca et periclinale incrassato, 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.

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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 aversiculate; 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, doliform 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 extruente. 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, cylindranei, recti vel laeve incurvati, 0(-1)-septati, ramulis primariis 15-30 × 4-5 µm, 1-4 ramulos secundarios 8-22 × 4-5 µm parientibus, ipsi 1-3 ramulos tertiarios 10-15 × 3-4 µm parientes. Phialides hyalinae, laeves, doliformes vel reniformes an cylindraneae, 8-18 × 3-5 µm, apice minute periclinaleque incrassatae, collo apperto, effuso, quasi inconspicuis. Conidia cylindrica, (28-)33-36(-38) × 2.5-3 µm, 1-septata, sine absicionis cicatibus visilibus, in muco incolorate agglomerata. Chlamydosporae globosae vel ellipsoideae, satis brunnae, crassitunicatae, pauce numerosae, 6-25 × 7-12 µm, saepe in microsclerotiiis 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 aversiculate, 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 × 4-5 µm, each producing 1-4 secondary branches, 8-22 × 4-5 µm, each of which in turn produces 1-3 tertiary branches, 10-15 × 3-4 µm. Phialides colorless, smooth, doliform to reniform or subcylindrical, 8-18 × 3-5 µm, apex with minute periclinal thickening, collarete inconspicuous, flared. Conidia cylindrical, (28-)33-36(-38) × 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.

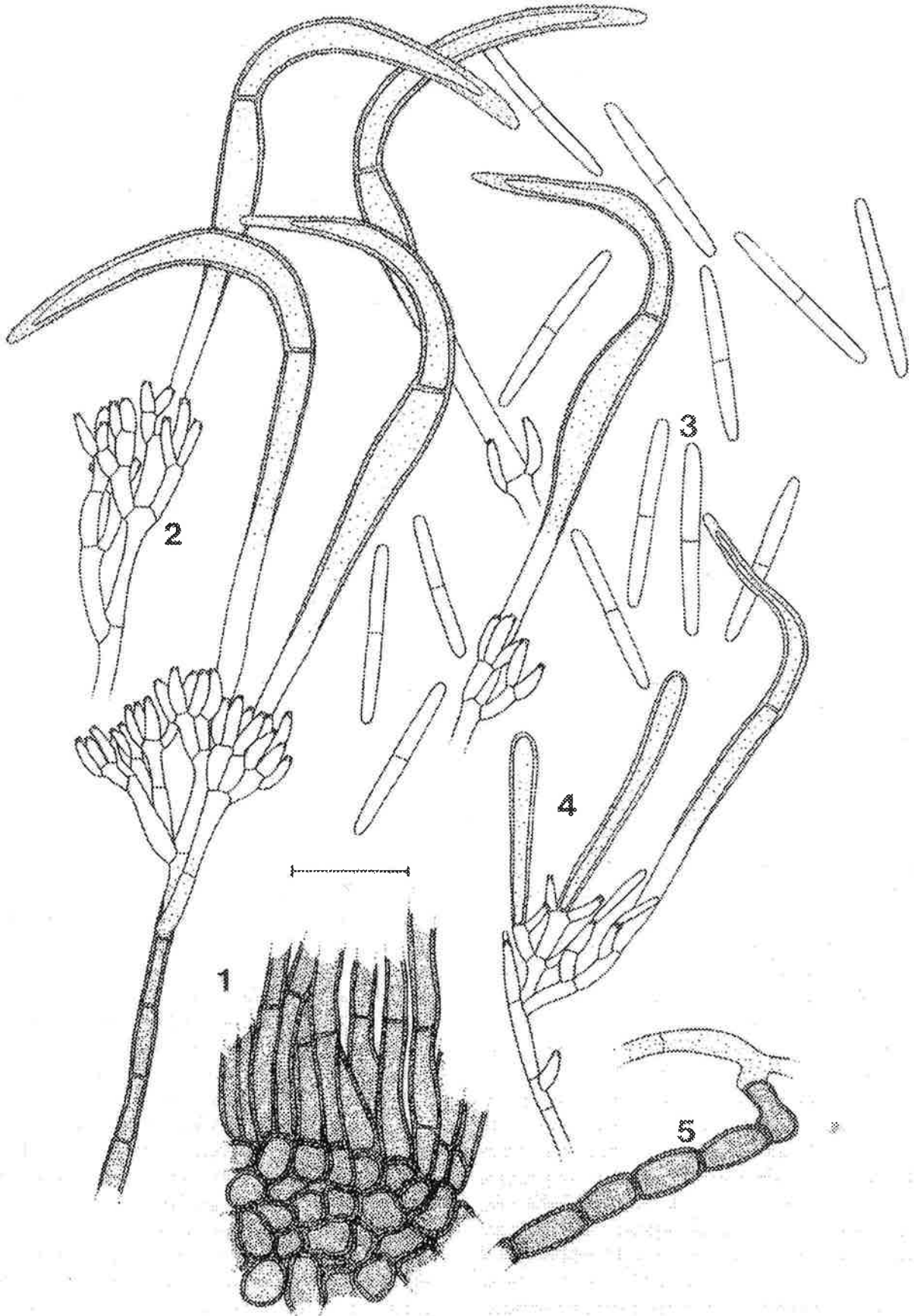
Substrate. Decaying angiospermous leaves and seeds.

Known distribution. French Guiana.

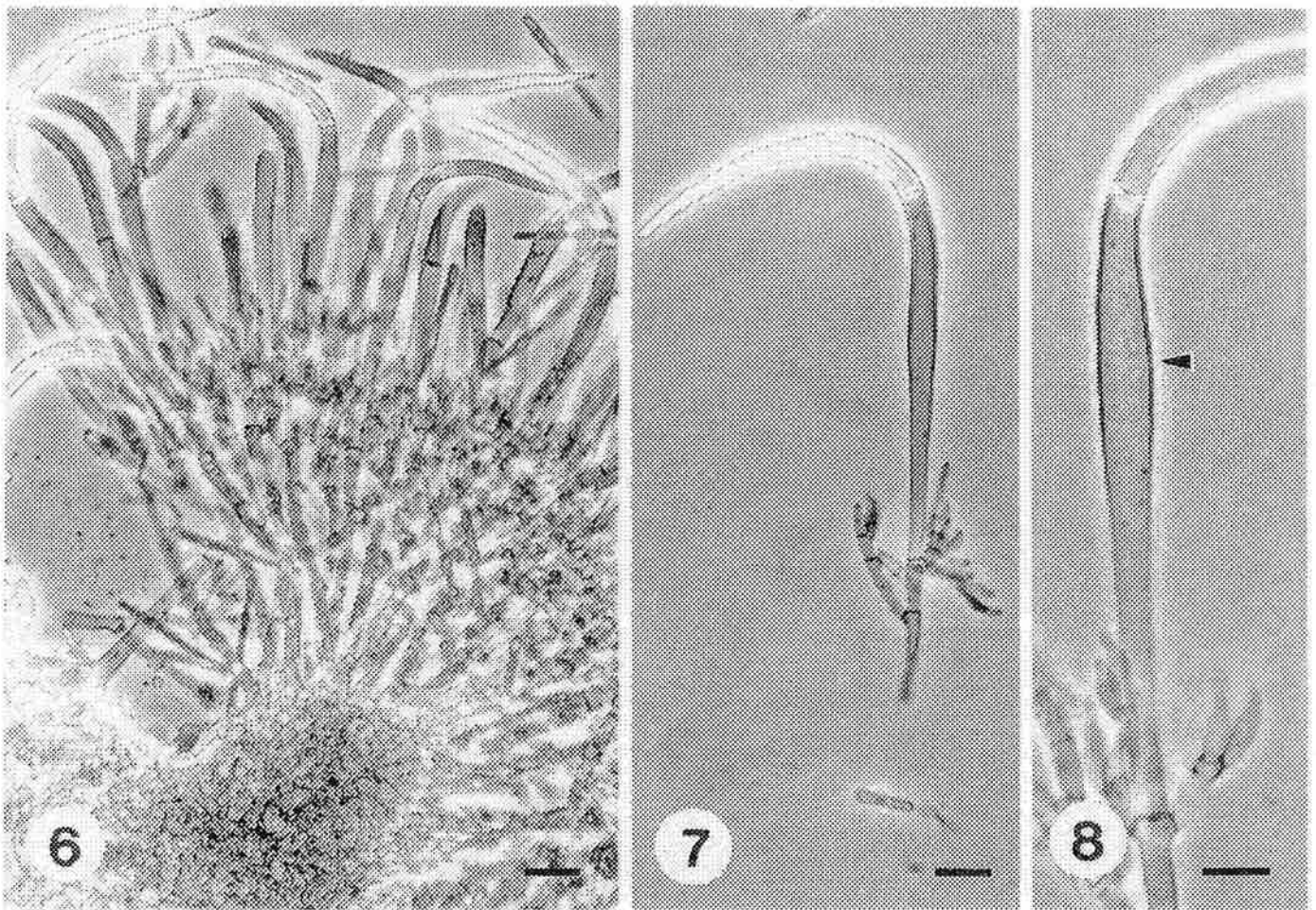
HOLOTYPE. FRENCH GUIANA. Matoury, first part of the Lamirande trail, on decaying leaf of unknown angiosperm, 23 Jan. 1997, C. Decock FG2240, specimen MUCL 40269 (culture ex-type MUCL 40269b, STE-U 1595).

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. aversiculatum* Gill et al. also is known to have thick-walled, faintly pigmented, aversiculate 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-



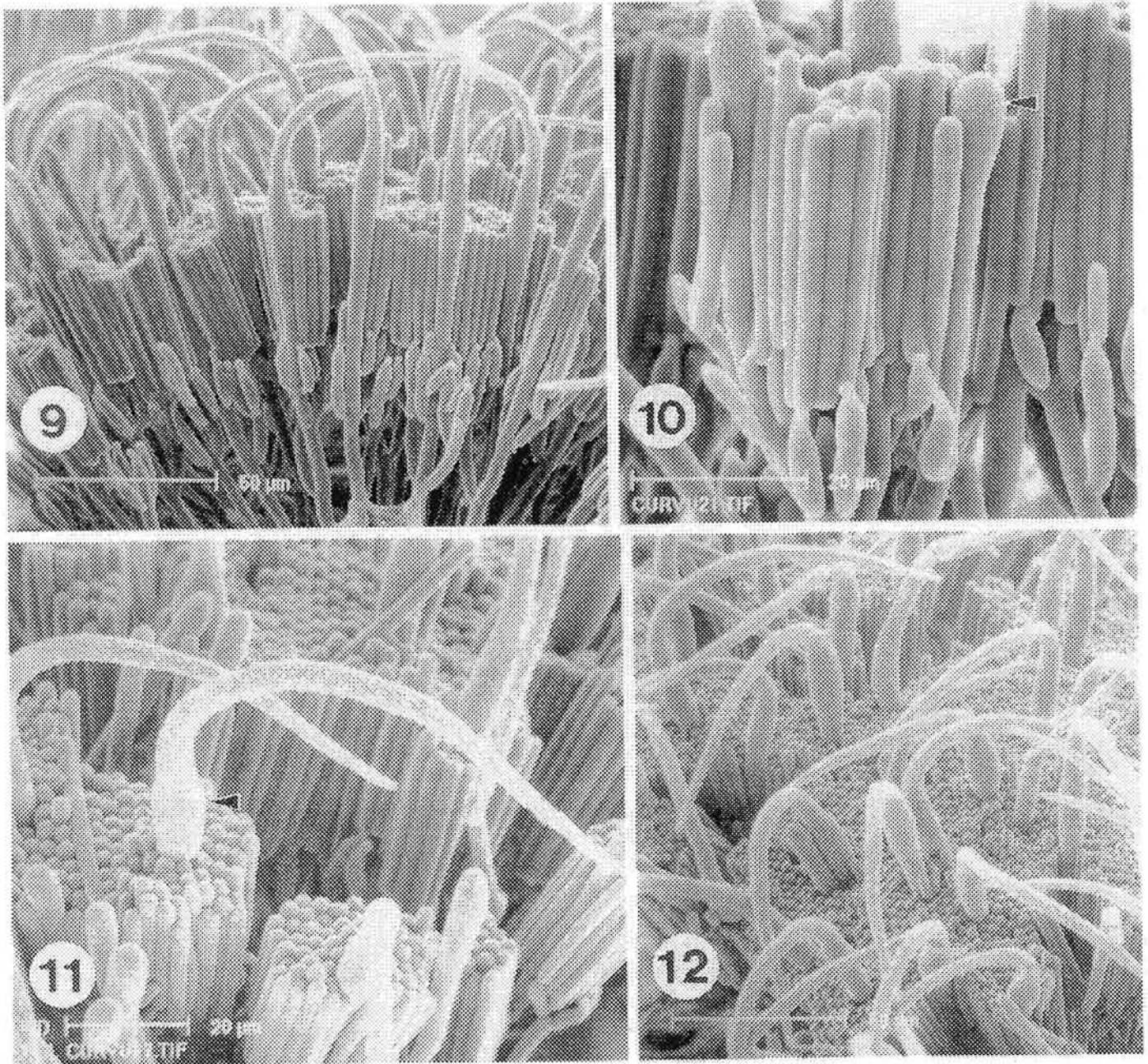
FIGS. 1-5. *Curvocladium cigneum* (MUCL 40269). 1. Stroma giving rise to a sporodochium of conidiophores. 2. Conidiophores with prominently curved stipe extensions. 3. Cylindrical 1-septate conidia. 4. Conidiophore with three immature stipe extensions. 5. Chlamydospores. Bar = 10 μ m.



FIGS. 6-8. *Curvocladium 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 *Curvocladium*. The genus *Cylindrocladiella* is known to have conidiophores that have one basal septum in their stipe extension. 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 *Thozziella* Kurtze can be easily distinguished from *Curvocladium* 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 avesiculate 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 *Curvocladium*. Contrary to the wider concept of *Cylindrocladium* proposed by Carmichael et al. (1980) and Peeraly (1991), subsequent research found genera such as *Cylindrocladiella* and *Gliocladiopsis* to be distinct (Crous and Wingfield, 1993; Crous and Peeraly, 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 *Curvocladium* 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* (MDCL 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

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|--|-----------------------|--|----------------------------|
| 1. Conidiophores penicillate, separate | 8 | 5. Stipe extensions without apical vesicles | <i>Thozzeria</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 | ? |
| 3. Conidia ellipsoidal, non-appendaged; stipe extensions pigmented | <i>Sarcopodium</i> | 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 | <i>Curvocladium</i> |
| 4. Conidiophores without stipe extensions | <i>Gliocladiopsis</i> | 8. Stipe extensions aseptate, thick-walled; conidia shorter than 25 µm, arranged in irregular packages; phialide collarettes convergent? | <i>Cylindrocladiella</i> |
| 4. Conidiophores with stipe extensions | 6 | 8. Stipe extensions septate, thin-walled; conidia lon- | |

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

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LITERATURE CITED

- Carmichael, J. W., W. B. Kendrick, I. L. Connors, and L. Sigler. 1980. *Genera of Hyphomycetes*. University of Alberta Press, Edmonton, Alberta, Canada. 386 pp.
- Courtecuisse, R., G. J. Samuels, M. Hoff, A. Y. Rossman, G. Cremers, S. M. Huhndorf and S. L. Stephenson. 1996. Check-list of fungi from French Guiana. *Mycotaxon* 57: 1-85.
- Crous, P. W., W. B. Kendrick, and A. C. Alfenas. 1997. New species of hyphomycetes associated with *Eucalyptus*. S. *African J. Bot.* 63: 286-290.
- _____, and A. Peerally. 1996. *Gliocladiopsis irregularis* sp. nov. and notes on *Cylindrocladium spathiphylli*. *Mycotaxon* 58: 119-128.
- _____, A. J. L. Phillips, and M. J. Wingfield. 1992. Effects of cultural conditions on vesicle and conidium morphology in species of *Cylindrocladium* and *Cylindrocladiella*. *Mycologia* 84: 497-504.
- _____, and M. J. Wingfield. 1993. A re-evaluation of *Cylindrocladiella*, and a comparison with allied genera. *Mycotaxon Res.* 97: 433-448.
- _____, and _____. 1994. A monograph of *Cylindrocladium*, including anamorphs of *Calonectria*. *Mycotaxon* 51: 341-435.
- _____, _____. A. C. Alfenas, and F. A. Da Silveira. 1994. *Cylindrocladium naviculatum* sp. nov., and two new vesiculate hyphomycete genera, *Falcocladium* and *Vesicla-diella*. *Mycotaxon* 50: 441-458.
- DeCock, C., G. L. Hennebert, and P. W. Crous. 1997. *Nectria serpens* sp. nov. and its hyphomycetous anamorph *Xenocylindrocladium* gen. nov. *Mycol. Res.* 101: 786-790.
- Matsushima, T. 1971. *Microfungi of the Solomon islands and Papua-New Guinea*. Kobe, published by the author. 78 pp., 169 figures and 48 plates.
- Peerally, A. 1991. The classification and phytopathology of *Cylindrocladium* species. *Mycotaxon* 40: 323-366.
- Rayner, R. W. 1970. *A mycological colour chart*. CMI and British Mycological Society. Kew, Surrey, England. 34 pp. and 17 sheets.
- Rossmann, A. Y. 1979. *Calonectria* and its type species, *C. daldiniana*, a later synonym of *C. pyrochroa*. *Mycotaxon* 8: 321-328.
- _____. 1983. The phragmosporous species of *Nectria* and related genera. *Mycol. Pap.* 150: 1-164.
- Samuels, G. J., A. Y. Rossman, R. Lowen, and C. T. Rogerson. 1991. A synopsis of *Nectria* subgen. *Dialonectria*. *Mycol. Pap.* 164: 1-48.
- Sutton, B. C. 1981. *Sarcopodium* and its synonyms. 1981. *Trans. Brit. Mycol. Soc.* 76: 97-102.