# A re-evaluation of *Cylindrocladiella*, and a comparison with morphologically similar genera

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*Cylindrocladiella* is confirmed as distinct from *Cylindrocladium*. Species of *Cylindrocladium* are primarily distinguished from *Cylindrocladiella* by septate stipes, more numerously branched conidiophores, only penicillate conidiophores and *Calonectria* teleomorphs. *Cylindrocladiella*, however, has non-septate stipes, small 1-septate conidia, penicillate and subverticillate conidiophores, chlamydospores that are arranged in chains, phialides with extending, prominent collarettes, conidia in slimy masses (as opposed to clusters), strong cultural odours and *Nectria* teleomorphs. Six *Cylindrocladiella* spp. are recognized. *C. peruviana* is placed in synonymy with *C. camelliae*, while *C. elegans* and *C. lageniformis* are described as new. *Gliocladiopsis* is distinguished from *Cylindrocladiella* by the absence of a stipe, the presence of more numerous conidiophore branches and the formation of conidia in slimy yellow masses. *Gliocladiopsis* is distinguished from *Cylindrocarpon* by having uniformly cylindrical conidia, more numerous conidiophore branches, and more numerous phialides per branch. *Cylindrocarpon tenue* is shown to be better accommodated in *Gliocladiopsis*, and the name *G. tenuis* proposed. The taxonomic position of *Acontiopsis* is uncertain, due to its vague generic description and the absence of type material.

The genus *Cylindrocladium* was established for the single species *C. scoparium* Morgan (1892). The primary distinguishing characteristic was the presence of cylindrical septate conidia. The stipe extension above the conidiogenous apparatus (referred to here as the stipe) was not mentioned in the diagnosis, but its existence became known later (Anderson, 1918; Boedijn & Reitsma, 1950).

In the first review of *Cylindrocladium*, *Candelospora* Hawley apud Rea & Hawley (1912) was treated as a synonym, and all relevant new combinations made (Boedijn & Rietsma, 1950; Tubaki, 1958). Subsequently, *Tetracytum* Vanderwalle (1945) was also recognized as a synonym of *Cylindrocladium* (Subramanian, 1971; Domsch, Gams & Anderson, 1980; Brayford & Chapman, 1987).

Boesewinkel (1982) believed that several species of *Cylindrocladium* with small conidia were distinct from those with larger conidia and septate stipes. On this basis he transferred the names of these fungi to a new genus, *Cylindrocladiella* Boesewinkel. Species of *Cylindrocladiella* were also distinguished from *Cylindrocladium* by cultural criteria, chlamydospore arrangement, the presence of penicillate as well as subverticillate conidiophores, *Nectria* (Fr.) Fr. as opposed to *Calonectria* De Not. teleomorphs, non-septate, unbranched, central stipes and obvious collarettes (*sensu* Sutton, 1980) on the phialides, conidial arrangement on conidiophores, as well as the small, 1-septate conidia (Boesewinkel, 1982).

Species of *Cylindrocladiella* are frequently associated with leaf spot and root rot symptoms of various hosts (Peerally, 1974; Boesewinkel, 1982; Sharma & Mohanan, 1982). Although there are conflicting reports regarding the pathogenicity of *C. parva* (Anderson) Boesewinkel (Sharma & Mohanan, 1982; Sobers & Alfieri, 1982; Crous, Phillips & Wingfield, 1992*b*), other species in the genus have been shown to be pathogenic to various hosts (Crous *et al.*, 1992*b*), and some have been reported to cause significant damage to economic plants (Mohanan & Sharma, 1985; Peerally, 1991).

The status of *Cylindrocladiella* as a genus has recently been contested (Peerally, 1991; Sharma & Mohanan, 1991). This study was undertaken to consider the distinction between *Cylindrocladiella* and other morphologically similar genera such as *Cylindrocladium* (Peerally, 1991), *Acontiopsis* Negru (Kendrick & Carmichael, 1973; Peerally, 1991), *Cylindrocarpon* Wollenw. (syn. *Moeszia* Bubak) (Tubaki, 1958; von Arx, 1970) and *Gliocladiopsis* Saksena (Agnihothrudu, 1959; Barron, 1968).

## MATERIALS AND METHODS

### *Evaluation of anamorphs*

Cultures derived from single conidia were plated on to carnation-leaf agar (CLA) (Fisher *et al.*, 1982; Crous, Phillips & Wingfield, 1992*a*), incubated at 25 °C under nuv, and examined after 7 d. Only material occurring on the leaves was

examined. Mounts were prepared in lactophenol cotton blue. All measurements were made under the (100 ×) oil-immersion objective. Wherever possible, fifty examples of each structure were measured. The data were analysed (Table 1) by Least Significant Difference (L.S.D.) at a probability level of $P = 0{\cdot}05$. Where less material was available, or when it was of insufficient quality, averages are not included. Cultures and types are lodged at the National Collection of Fungi, Pretoria (PREM).

***Vesicle shape and stipe length.*** Vesicle shape was determined on CLA after 7 d incubation. Vesicles examined were all on stipes of conidiophores, with at least one primary and one secondary branch bearing phialides. Vesicles that showed signs of proliferation were ignored. Vesicle width was measured at the widest point, and stipe length measured from the basal septum to the vesicle tip.

***Collarettes and conidiophores.*** Conidiophores were examined after 7 d on CLA to determine if they were either penicillate or subverticillate, or if both conidiophore types were present. Phialides were also examined for the presence or absence of collarettes.

### *Cultural characteristics*

***Growth studies.*** To determine the maximum radial growth of species in culture, agar plugs from the periphery of 7-d-old colonies (3 mm diam.) of each fungus were plated at the centre of malt-extract agar (MEA) (20 g Oxoid malt extract, 15 g Difco agar, 1000 ml $H_2O$) plates, and incubated at 25° for 1 d to ensure active growth. Growth after 1 d was marked, and thereafter plates were placed at the respective temperatures under consideration. Growth was assessed for all isolates after 6 d of incubation in the dark at 5, 8, 10, 15, 20, 25, 33 and 35°, with three replicate plates of each isolate at each temperature. Radial growth was also determined after 3 d at 25 and 30°. Average growth was calculated from four radial measurements from each of the three plates. The experiment was repeated at least once for all isolates. The rationale for including 8 and 33° with the other 5° intervals was that the growth of many species began to slow or stop between 5 and 10 and between 30 and 35°. These temperatures were therefore necessary to determine a finer distinction between minimum and maximum temperature requirements for growth.

***Chlamydospores and colony colour.*** Chlamydospore measurements were found to be variable, and were therefore ignored. Production of chlamydospores and microsclerotia was, however, rated for the extent of thickened, pigmented hyphae present after 6 d (viewed from the underside of plates), at the completion of the growth studies. Dark brown, medium brown and light brown colonies were used as categories to define extensive, medium and slight chlamydospore production respectively. Colony colours were rated simultaneously with chlamydospore production, as the amount of chlamydospores formed directly influenced the colony colours. To ensure homogeneity of results, ratings were made independently by two observers and results compared. Colours were taken from Methuen (Kornerup & Wanscher, 1967) and Rayner (1970).

## RESULTS

### *Evaluation of anamorphs*

Six vesicle classes were recognized for *Cylindrocladiella* spp.: irregularly lanceolate, ellipsoid to lanceolate, ellipsoid to clavate, cylindrical, clavate to pyriform and lageniform to ovoid (Figs 1–6). Although *C. parva* and *C. novae-zelandiae* (Boesew.) Boesew. were both characterized by penicillate conidiophores without obvious collarettes on doliiform to cymbiform phialides, stipe lengths of *C. parva* were significantly shorter ($P = 0{\cdot}05$) than those of *C. novae-zelandiae* (Table 1). *C. elegans* sp. nov., *C. infestans* Boesew. and *C. novae-zelandiae* had very similar conidial dimensions when examined on CLA, making it difficult to distinguish these species solely on this basis. Similar conidial dimensions were also observed for *C. camelliae* (Venkataramani & Venkata Ram) Boesew. and *C. lageniformis* sp. nov. (Table 1). In contrast to *Cylindrocladium*, stipes were nearly always formed at the centre of the conidiophore, and were never branched.

### *Cultural characteristics*

*Cylindrocladiella* spp. could easily be distinguished from each other by their minimum and maximum temperature requirements for growth. The ability to grow at either very high or low temperatures enabled species to be grouped into either high (growing above 30°) or low (growing below 10°) temperature classes (Figs 7–12). *Cylindrocladiella* spp. could also easily be distinguished in the same way from *Gliocladiopsis sagariensis* Saksena, which was capable of growing at much higher temperatures than any species of *Cylindrocladiella*.

As reported by Boesewinkel (1981, 1982), chlamydospore formation can be used to further distinguish *Cylindrocladiella* spp. from each other (Table 1). Some degree of variation was, however, found in different isolates of certain species, thus reducing the value of this criterion. After 6 d on MEA, colony pigmentation in all spp. except *C. lageniformis* was chiefly the result of chlamydospore production. In *C. lageniformis*, however, a reddish pigment diffused readily into the medium, resulting in a darker colony.

## TAXONOMY

**Cylindrocladiella** Boesewinkel, *Can. J. Bot.* **60**: 2289 (1982).

*Conidiophores* hyaline, single, subverticillate, as well as penicillate, with primary and secondary branches. *Phialides* terminal, hyaline, in whorls of 2–4, with or without obvious collarettes. *Stipe* mostly centrally arranged on conidiophore, with a single basal septum, terminating in a thin-walled, hyaline vesicle of characteristic shape. *Conidia* hyaline, (0)–1-septate, sometimes becoming swollen at one end with age. *Chlamydospores* more frequently arranged in chains than clusters.

*Teleomorph*: *Nectria*.

**Table 1.** A comparison of morphological and cultural characteristics of *Cylindrocladiella* spp.

| | Vesicle shape | Stipe length* (µm) | Phialide shape | Collarettes | Subverticillate conidiophores | Vesicle width* | Chlamydospore production† | Temperature requirements | | | Conidial dimensions (µm)* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Min. | Opt. | Max. | Length | Width |
| *C. camelliae* | Ellipsoid to lanceolate | (75)–108–(135) | Doliiform to reni to cymbiform | Present | Common | (3·5)–4–(5·5) | Extensive | Above 5 | 25 | Above 35 | (9)–12·5–(15) | (1·9)–2–(2·5) |
| *C. elegans* | Ellipsoid to clavate | (65)–92–(125) | Doliiform to reni to cymbiform | Present | Moderate to rare | (4)–5–(6) | Medium numbers | Above 5 | 20 | Below 30 | (12·5)–14·5–(18) | (1·9)–2–(3) |
| *C. infestans* | Lanceolate to cylindrical | (71)–88–(130) | Doliiform to reni to cymbiform | Present | Common | (3)–3·5–(4) | Medium numbers | Above 8 | 25 | Below 35 | (10)–14·5–(22·5) | (1·9)–2·5–(3) |
| *C. lageniformis* | Lageniform to ovoid | (63)–80–(120) | Doliiform to reni to cymbiform | Present | Moderate to rare | (9)–12–(18) | Extensive | Above 5 | 25 | Below 35 | (9)–11·5–(15) | (1·5)–1·8–(3) |
| *C. novae-zelandiae* | Irregularly lanceolate | (95)–103–(125) | Doliiform to reniform | Absent | Rare | (3·5)–5–(9) | Slight | Below 5 | 20 | Below 30 | (11·3)–14·5–(25) | (1·9)–2·5–(3·2) |
| *C. parva* | Clavate to pyriform | (65)–75–(90) | Doliiform to reniform | Absent | Rare | (4)–5·5–(8) | Extensive | Below 5 | 25 | Below 30 | (13·5)–17–(19·5) | (2)–2·5–(3) |
| L.S.D. ($P = 0·05$) | | 16·70 | | | | 1·37 | | | | | 1·72 | 0·25 |

* Measurements represent an average of 50 observations on CLA plates incubated at 25° for 7 d under nuv light.

† Rated on three replicate MEA plates after 6 d at 25° in the dark. Dark brown = extensive chlamydospore formation, medium brown = medium numbers, light cream = slight.

*Type species*: *C. parva* (Anderson) Boesewinkel.

In this study, six species of *Cylindrocladiella* are recognized. *C. peruviana* (Bat., Bez. & Herrera) Boesewinkel is reduced to synonymy under *C. camelliae*, while *C. lageniformis* and *C. elegans* are described as new.

## *Keys to* Cylindrocladiella *spp.*

Synoptic and dichotomous keys are provided. All measurements have been made from type cultures on CLA under nuv at 25° after 7 d, or from dried type material if no cultures were available. Cultural characteristics were recorded on MEA after incubation for 6 d in the dark at 25°.

### *Synoptic key*

1 *C. camelliae* 4 *C. lageniformis*
2 *C. elegans* 5 *C. novae-zelandiae*
3 *C. infestans* 6 *C. parva*

Vesicle shape:
- irregularly lanceolate to ellipsoid or cylindrical — 1, 3, 5
- clavate to pyriform — 6
- clavate to ellipsoid — 2
- lageniform to ovoid — 4

Stipe length:
- up to 110 µm long — 6
- longer than 110 µm — 1, 2, 3, 4, 5

Phialide shape in penicillate conidiophores:
- reniform to doliiform or cymbiform — 1, 2, 3, 4
- doliiform to cymbiform — 5, 6

Subverticillate conidiophores:
- abundant — 1, 3
- rare to absent — 2, 4, 5, 6

Phialide collarettes:
- abundant — 1, 2, 3, 4
- rare to absent — 5, 6

Sporulation on aerial mycelium:
- medium — 2, 5, 6
- extensive — 1, 3, 4

Conidium length (mean):
- 11·0–12·5 µm — 1, 4
- 14·0–14·5 µm — 2, 3, 5
- 16·5–17·0 µm — 6

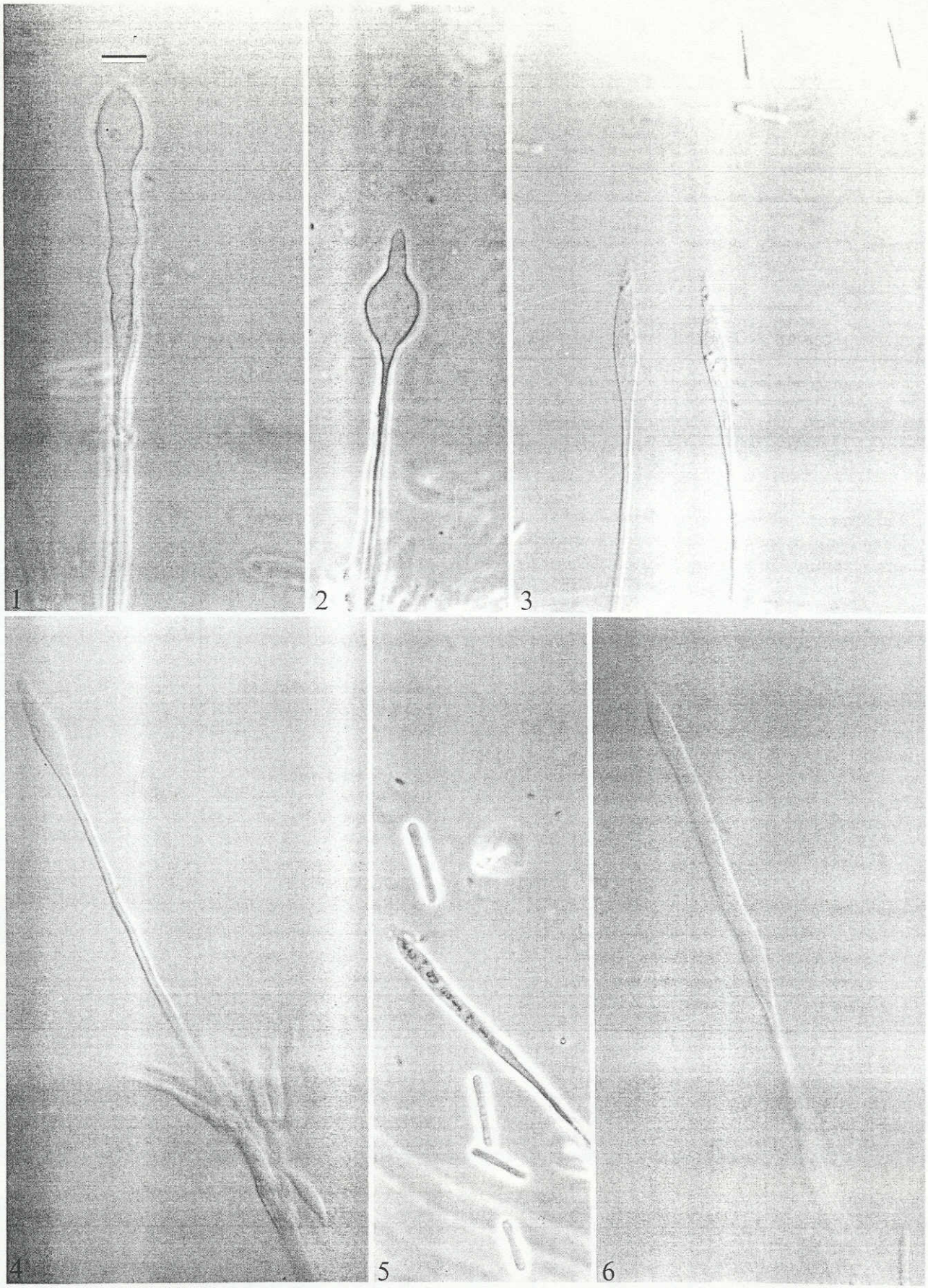
Conidium width (mean):
- 1·8–2·0 µm — 1, 2, 4
- 2·5 µm — 3, 5, 6

Chlamydospores on MEA:
- few in number (colony pale yellow) — 5
- medium in number (colony light brown) — 2, 3
- numerous (colony dark brown) — 1, 4, 6

Minimum temperature requirement for growth:
- below 5° — 5, 6
- above 5° — 1, 2, 4
- above 8° — 3

Optimum temperature requirement for growth:
- 20° — 2, 5
- 25° — 1, 3, 4, 6

Maximum temperature requirement for growth:
- below 30° — 2, 5
- below 33° — 6
- above 35° — 1, 3, 4




**Figs 1–6.** Vesicles of *Cylindrocladiella* spp. Bar = 10 µm. **Fig. 1.** Pyriform vesicle of *C. parva*. **Fig. 2.** Lageniform vesicle of *C. lageniformis*. **Fig. 3.** Ellipsoid vesicles of *C. camelliae*. **Fig. 4.** Conidiophore of *C. elegans* with ellipsoid vesicle. **Fig. 5.** Cylindrical vesicle of *C. infestans*. **Fig. 6.** Irregularly lanceolate vesicle of *C. novae-zelandiae*.

**Dichotomous key**

1. Subverticillate conidiophores absent . . . . . 2
1. Subverticillate conidiophores present . . . . . 3
2. Vesicles clavate to pyriform; conidia (13·5)–17–(19·5) × (2)–2·5–(3) µm . . . . . *C. parva*
2. Vesicles narrowly and irregularly lanceolate; conidia (11·3)–14·5–(25) × (1·9)–2·5–(3·2) µm . . . . *C. novae-zelandiae*
3. Vesicles lageniform to ovoid; conidia (9)–11·5–(15) × (1·5)–1·8–(2) µm . . . . . *C. lageniformis*
3. Vesicles not as above. . . . . 4
4. Vesicles lanceolate to cylindrical; conidia (10)–14·3–(22·5) × (2)–2·5–(3) µm . . . . . *C. infestans*
4. Vesicles not as above . . . . . 5
5. Vesicles ellipsoid to lanceolate; conidia (9)–12·5–(15) × (1·9)–2–(2·5) µm . . . . . *C. camelliae*
5. Vesicles clavate to ellipsoid; conidia (12·5)–14·5–(18) × 2–(3) µm . . . . . *C. elegans*

**Cylindrocladiella camelliae** (Venkataramani & Venkata Ram) Boesewinkel, *Can. J. Bot.* **60**: 2289 (1982).

*Cylindrocladium camelliae* Venkataramani & Venkata Ram, *Curr. Sci.* **30**: 186 (1961).

*Cylindrocladium peruvianum* Batista, Bezerra & Herrera, *Atas Inst. Micol.* **2**: 388 (1965).

*Cylindrocladiella peruviana* (Bat., Bez. & Herrera) Boesewinkel, *Can. J. Bot.* **60**: 2289 (1982).

*Cylindrocladiella mangiferae* Chowdhry, *Indian Phytopath.* **43**: 253 (1990).

***Morphology.*** *Vesicles* ellipsoid to lanceolate (Figs 3, 13), (3·5)–4·0–(5·5) µm wide. *Stipes* unbranched, in middle of conidiophore, having one basal septum, (75)–108–(135) µm long. *Penicillate conidiophores*, primary branches 0–(1)-septate, (15)–20–(25) × (2·5)–3·5–(4) µm, secondary branches non-septate, (9)–10–(13) × 2·5–(3) µm, phialides doliiform to reniform to cymbiform, (10)–12·5–(17) × (2·5)–3–(3·5) µm with abundant collarettes. *Subverticillate conidiophores* abundant, phialides cymbiform to cylindrical (15)–21·5–(26) × (2)–3–(3·5) µm. *Conidia* (0)–1-septate, (9)–12·5–(15) × (1·9)–2–(2·5) µm. *Colony colour* (reverse), 19D–15″i buff yellow to sayal brown (Rayner, 1970), 4B4–5D6 straw yellow–champagne to oak–golden brown (Kornerup & Wanscher, 1967). *Chlamydospores* extensive, in chains.

***Temperature requirements.*** Minimum above 5°; maximum above 35°; optimum 25°. This is both a high- and low-temperature species (Fig. 9), with extensive sporulation on aerial mycelium.

***Disease.*** Root rot, leaf spot (Peerally, 1974; Mohanan & Sharma, 1985; Crous *et al.*, 1992*b*).

***Hosts.*** *Acacia dealbata* Link, *A. mearnsii* De Wild., *Amorphophallus* sp., *Arenga pinnata* Merr., *Camellia sinensis* Kuntze, *Eucalyptus* spp., *Mangifera indica* L., *Myristica fragrans* Houtt., *Pinus sylvestris* L., *Synoum* sp. (Venkataramani & Venkata Ram, 1961; Peerally, 1974; Rahman *et al.*, 1981; Mohanan & Sharma, 1985). Also isolated from ants (Batista *et al.*, 1965).

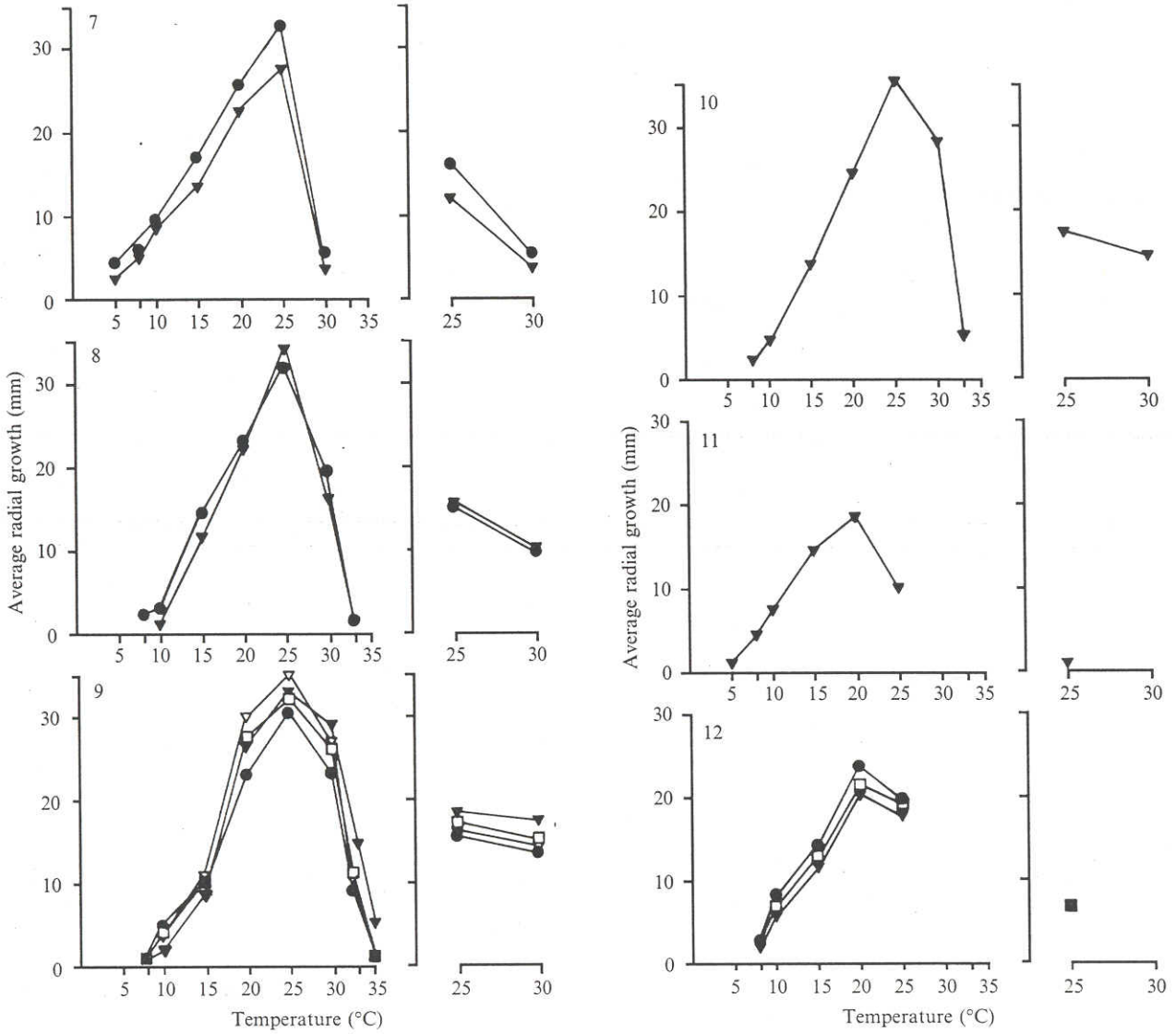
***Geographical distribution.*** Australia, Brazil, India, Jamaica, Mauritius, New Zealand, South Africa, Sri Lanka, Thailand (Terashita, 1968; Peerally, 1974; Shipton, 1977; Rahman *et al.*, 1981; Boesewinkel, 1982; Mohanan & Sharma, 1985).

***Notes.*** Boesewinkel (1981, 1982) distinguished *C. peruviana* from *C. camelliae* by the ability of *C. peruviana* to form microsclerotia in culture. He also found, however, that both species had a minimum temperature requirement for growth above 5°, and a maximum above 30°. Furthermore, both had penicillate as well as subverticillate conidiophores, with *C. camelliae* having conidial dimensions of 11–15 × 1·8 µm, and *C. peruviana* 10–15 × 2–3 µm. Boesewinkel (1982) thus concluded that *C. peruviana* is very similar to *C. camelliae*, but retained them as separate species.

Despite considerable effort, the type culture of *C. peruviana* (IMUR 1843) could not be obtained from Recife, Brazil. An examination of a dried specimen derived from the original type culture of *C. peruviana* (IMI 170223 on PDA, IMI 309038 on CLA) showed the vesicles to be ellipsoid. Conidia were 10·5–13 × 1·9–2 µm similar to those of *C. camelliae*, which measured 9·5–13 × 2·5 µm (IMI 174836, type on agar). The slightly wider conidia observed on the type of *C. camelliae* probably resulted from a lengthy incubation period. It can therefore be concluded that *C. peruviana* is a later synonym of *C. camelliae*.

Boesewinkel (1982) noted that *Nectria camelliae* is the teleomorph of *C. infestans*, not of *C. camelliae*. In the original description of *Calonectria camelliae* Shipton (1979), the exact nature of the vesicle of the anamorph was not illustrated. An examination of the type specimen (IMI 174836) in this study found conidia to be 9·5–13 × 2·5–3 µm. As no vesicles were present on the dried type, the ex-type culture (ATCC 38571) was examined. When incubated on CLA, the subverticillate conidiophores were branched at more than one level, vesicles were cylindrical, and chlamydospore formation on MEA after 6 d was slight to medium. The findings of this study support those of Boesewinkel (1982), that *Nectria camelliae* is the teleomorph of *C. infestans*. No teleomorph is known for *C. camelliae*.

*Specimens examined*: Australia: *C. camelliae* on *Synoum* sp. (?), IMI 240339; soil 1973, IMI 174837. Brazil: Lima, Peru, *C. peruviana*, on ants, M. P. Herrera, 10 Apr. 1963, IMI 170223 (ex type); unknown host, 1986, IMI 309038. India: *Camellia sinensis*, 1951, Venkataramani & Venkata Ram, IMI 47717 (holotype of anamorph); *Mangifera indica* roots, ?, 1976, IMI 203862; *M. indica* roots, 1986, IMI 308439; *M. indica*, 1985, Chowdhry, IMI 317057 (as *C. mangiferae*). Japan: *Acacia dealbata* leaf, 12 Jan. 1971, T. Terashita, BPI 414548. Mauritius: *C. sinensis*, Peerally, 1970, IMI 167579. Great Britain: *Pinus sylvestris*, Ellis, 1956, IMI 67950.




**Figs 7–12.** Average radial colony growth (mm) of *Cylindrocladiella* spp. on MEA at various temperatures after 6 d (left) and 3 d (right) respectively. **Fig. 7.** *C. parva*, (●) = ATCC 28272; (▼) = PPRI 3999. **Fig. 8.** *C. infestans*, (●) = ATCC 38571; (▼) = ATCC 44816. **Fig. 9.** *C. camelliae*, (▼) = IMI 297470; (●) = PPRI 3990; (□) = PPRI 3992; (▽) = PPRI 3991. **Fig. 10.** *C. lageniformis*, (▼) = PPRI 4449. **Fig. 11.** *C. novae-zelandiae*, (▼) = ATCC 44815. **Fig. 12.** *C. elegans*, (●) = PPRI 4210; (□) = PPRI 4212; (▼) = PPRI 4050.

*Cultures examined*: Thailand: *Amorphophallus* sp. stem, R. Stevenson, 1985, IMI 297470. South Africa: Northern Transvaal, Tzaneen, Westfalia, *Eucalyptus grandis* stems, Feb. 1990, P. W. Crous, PPRI 3990, 3993; N. Natal, Kwambonambi, Mondi, *Eucalyptus* sp., May 1990, P. W. Crous, PPRI 3991; Natal, Top Crop nursery, *Acacia mearnsii*, P. W. Crous, Feb. 1990, PPRI 3992.

### **Cylindrocladiella elegans** Crous & Wingfield, sp. nov.

*Vesiculae* clavatae vel ellipticae (4)–5–(6) µm diam. *Stipites* inramosi, in medio conidiophoro, uno basali septo, (65)–92–(125) µm longi. *Conidiophora* penicillata, ramis primis 0–(1)-septatis, (10·0)–15·0–(20·0) × 3·0–(3·5) µm; ramis secundariis eseptatis, (10·0)–11·5–(16·0) × (3·5) µm, phialidibus doliiformibus vel reniformibus vel cymbiformibus, (11·0)–12·0–(15·0) × 3·0–(3·5) µm cum collariculis. *Conidiophora* subverticillata sparsa vel absentia. *Conidia* (0)–1-septata, (12·5)–14·5–(18·0) × 2·0–(3·0) µm, conidia abnormia 1–3-septis (usque 44 µm longa) quoque formata sunt. *Temperaturae* ad crescendum necessariae; minima plus quam 5°; maxima minus quam 30°; temperatura optima 20°. Haec est species minoris temperaturae, sporulatione media in myceliis aeriis. Fundus coloniae 19F maydiflavus (Rayner, 1970), 3A3 sub-flavus (Kornerup & Wanscher, 1967). *Chlamydosporae* formatae sunt mediis numeriis et dispositae sunt in catenis.

Holotypus PREM 50928 foliis ramius, Seven Oaks, Natal, R.S.A., 11 Oct. 1989, I. Rong.

***Morphology.*** *Vesicles* clavate to ellipsoid (Figs 4, 14) (4)–5–(6) µm wide. *Stipes* unbranched, in the middle of conidiophore, having one basal septum, (65)–92–(125) µm long. *Penicillate conidiophores*, primary branches 0–(1)-septate, (10·0)–15·0–(20·0) × 3·0–(3·5) µm, secondary branches non-septate, (10·0)–11·5–(16·0) × 3·0–(3·5) µm, phialides doliiform to reniform to cymbiform, (11·0)–12·0–(15·0) × 3·0–(3·5) µm with collarettes. *Subverticillate conidiophores* sparse to absent.

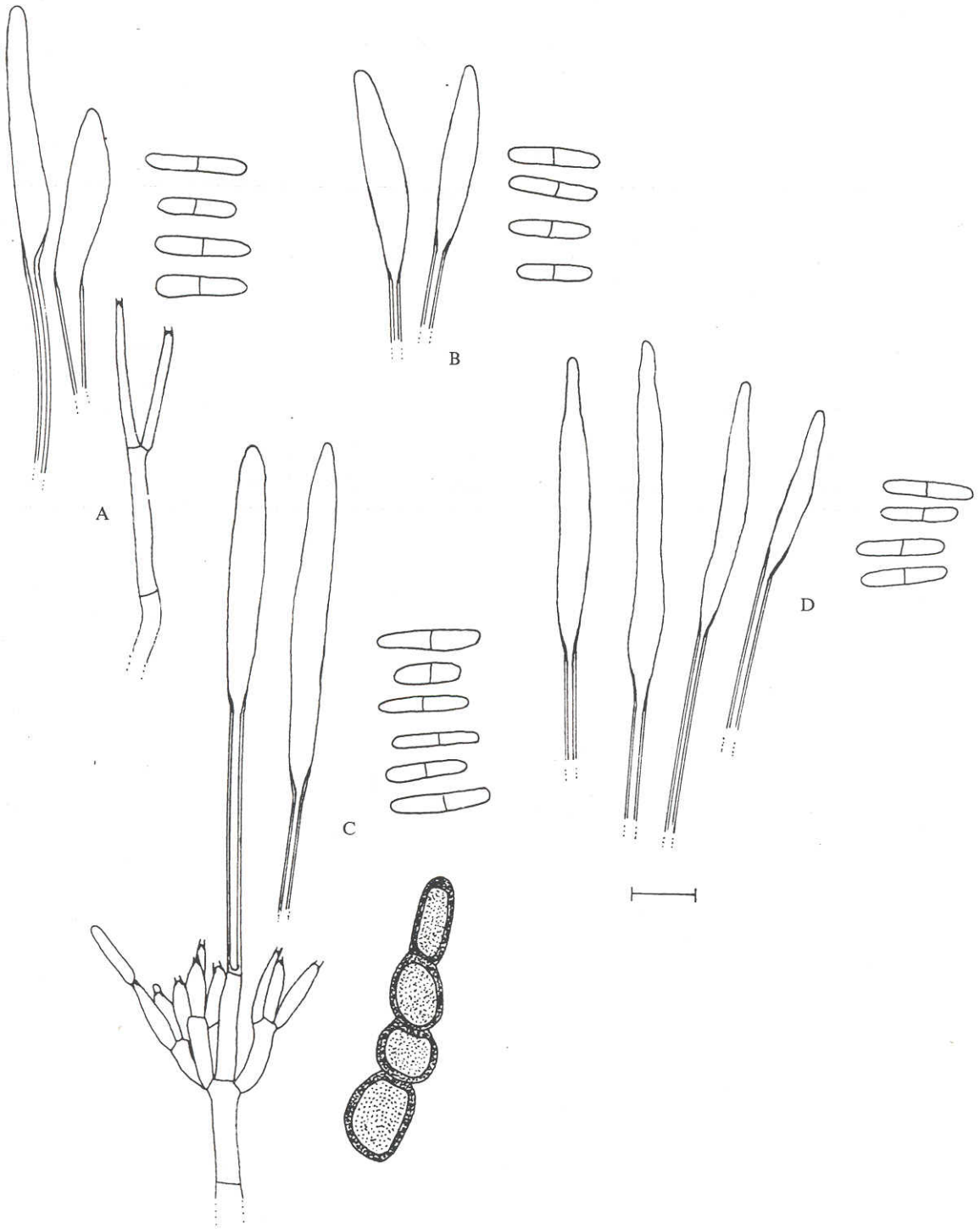



**Fig. 13. A–D.** *Cylindrocladiella camelliae*. Bar = 10 μm. A, Vesicles, conidia and subverticillate conidiophore (IMI 47717, type); B, vesicles and conidia (IMI 309038); C, conidiophore, vesicles, conidia and chlamydospores (IMI 297470a) and D, vesicles and conidia (PPRI 3993).

*Conidia* (0)–1-septate, (12·5)–14·5–(18·0) × (1·9)–2·0–(3·0) μm, abnormal conidia with 1–3 septa (up to 44 μm long) also formed. *Colony colour* (reverse), 19F maize yellow (Rayner, 1970), 3A3 pale yellow (Kornerup & Wanscher, 1967). *Chlamydospores* form in medium numbers, and are arranged in chains.

***Temperature requirements.*** Minimum above 5°; maximum below 30°; optimum 20°. This is a low-temperature species (Fig. 12), with medium sporulation on aerial mycelium.

***Disease.*** Root rot (Crous *et al.*, 1992*b*). Habitat on peanut roots, leaf litter and in soil.

***Hosts.*** *Arachis hypogaea* L., *Eucalyptus* leaf litter.

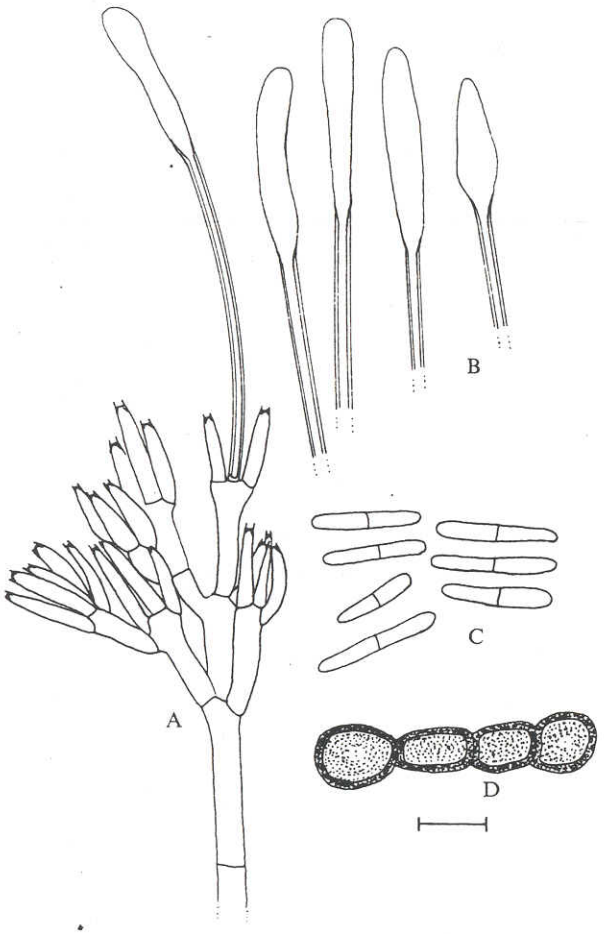



**Fig. 14. A–D.** *Cylindrocladiella elegans*. Bar = 10 µm. A, Conidiophore; B, vesicles; C, conidia and D, chlamydospores (PPRI 4050).

***Geographical distribution.*** South Africa.

***Notes.*** Some conidia formed in the type culture stay longer attached to phialides. These conidia become malformed, abnormally long, and can develop up to three septa. This phenomenon was observed after 7 d on CLA as well as on MEA, but disappeared with subculturing. *C. elegans* can be distinguished from all other *Cylindrocladiella* spp. by its colony colour, temperature requirements for growth, and vesicle morphology (Table 1).

*Specimen examined*: South Africa: Natal, Seven Oaks, leaf litter, I. Rong, 11 Oct. 1989, PREM 50928, holotype.

*Cultures examined*: South Africa: Natal, Seven Oaks, leaf litter, I. Rong, 11 Oct. 1989, PPRI 4050, CBS 338.92 (single-conidial isolate, type culture); Natal, Ndewde Forest, *Eucalyptus* debris, I. Rong, 12 Oct. 1989, PPRI 4210; N. Natal, Kwambonambi, *Arachis hypogaea* roots, M. J. Wingfield, Feb. 1991, PPRI 4211; Eastern Transvaal, Nelspruit, leaf litter, P. W. Crous, 14 Aug. 1990, PPRI 4212.

**Cylindrocladiella infestans** Boesewinkel, *Can. J. Bot.* **60**: 2290 (1982).

*Cylindrocladium infestans* (Boesew.) Peerally, *Mycotaxon* **40**: 337 (1991).

*Teleomorph*: *Nectria camelliae* (Shipton) Boesewinkel, *Can. J. Bot.* **60**: 2293 (1982).

*Calonectria camelliae* Shipton & Booth in Shipton, *Trans. Br. mycol. Soc.* **69**: 59 (1977).

*Calonectria camelliae* Shipton, *Trans. Br. mycol Soc.* **72**: 163 (1979).

*Nectria camelliae* (Shipton) Boesewinkel, *Trans. Br. mycol. Soc.* **78**: 555 (1982).

***Morphology.*** *Vesicles* lanceolate to cylindrical (Figs 5, 15), (3·0)–3·5–(4·0) µm wide. *Stipes* unbranched, in middle of conidiophore, having one basal septum, (71)–88–(130) µm long. *Penicillate conidiophores*, primary branches 0–(1)-septate, (10·0)–13·5–(18·0) × (3·0)–3·5 µm, secondary branches non-septate, (8·0)–10·0–(12·0) × (2·5)–3·0–(3·5) µm, phialides doliiform to reniform to cymbiform (7·0)–10·0–(13·0) × (2·0)–3·0–(3·5) µm with abundant collarettes. *Subverticillate conidiophores* abundant, phialides cymbiform to cylindrical, (15·0)–20·0–(25·0) × (2·5)–3·0–(3·5) µm. *Conidia* (0)–1-septate, (10·0)–14·5–(22·5) × (1·9)–2·5–(3·0) µm. *Colony colour* (reverse), 19D buff yellow (Rayner, 1970), 3B4–4B4 straw yellow to champagne (Kornerup & Wanscher, 1967). *Chlamydospores* form in medium numbers, and are arranged in chains.

***Temperature requirements.*** Minimum above 8°; maximum below 35°; optimum 25°. This is a high-temperature species (Fig. 8), with extensive sporulation on aerial mycelium.

***Teleomorph.*** *Perithecia*, 200–345 × 150–290 µm, turning blood-red in 3% KOH. Outer wall layer, 15–20 µm, elongated to angular cells, inner wall layer, 3–5 µm, elongated cells. *Asci* unitunicate, clavate to cylindrical, 50–68 × 5–7 µm, without apical discharge mechanism. *Ascospores* (Fig. 15) 1-septate, ellipsoid to clavate, uni- to biseriate 7–12 × 3–4 µm.

***Disease.*** Isolated from roots and stems of dying *Pinus pinea* L. seedlings (Boesewinkel, 1982).

***Hosts.*** *P. pinea*, *Eucalyptus* sp. (Boesewinkel, 1982).

***Geographical distribution.*** Australia, Brazil, New Zealand, Papua-New Guinea (Matsushima, 1971; Shipton, 1977, 1979; Boesewinkel, 1982).

***Notes.*** Matsushima (1971) illustrated (fig. 142) a collection of *C. parva* from Papua-New Guinea with morphological characteristics similar to those of *C. infestans*. Although the specimen was placed in *C. parva*, he illustrated the vesicles as cylindrical, with subverticillate conidiophores branching at more than one level. Type material of this species, which is lodged in Matsushima's personal herbarium (MFC 2687), could not be obtained. There can be little doubt, however, that this collection also represents *C. infestans*, and that this fungus, therefore, also occurs in Papua-New Guinea. A subsequent collection made from *Eucalyptus* cuttings in Brazil (PPRI 4450), also represents *C. infestans*.

*Specimen examined*: Australia: Queensland, *Calonectria camelliae*, fruit of a rain forest tree, Shipton, 1973, IMI 174836 (type of teleomorph).

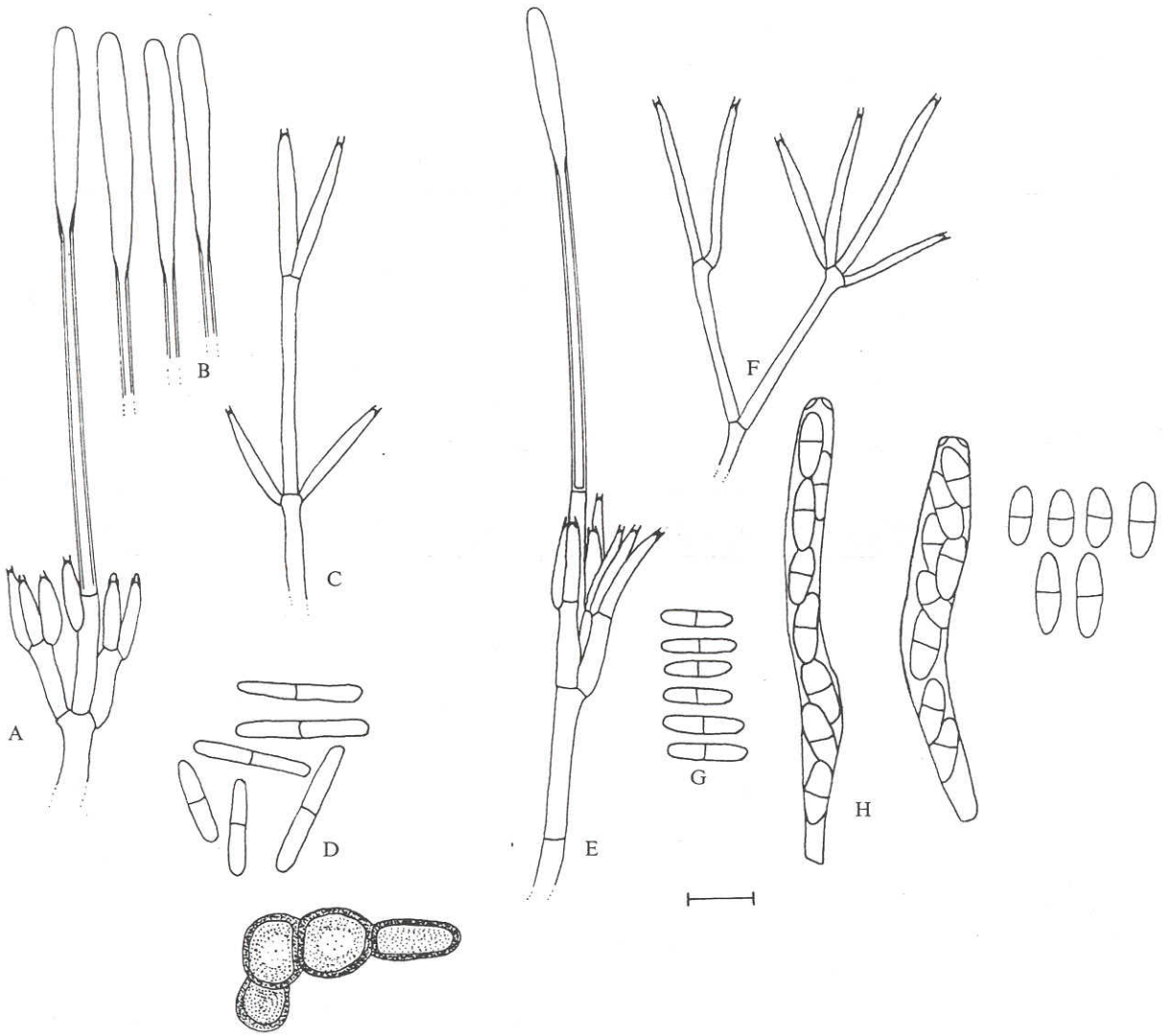



**Fig. 15. A–H.** *Nectria camelliae* and its *Cylindrocladiella infestans* anamorph. Bar = 10 µm. A, Penicillate conidiophore; B, vesicles; C, subverticillate conidiophore; D, conidia and chlamydospores (ATCC 44816, type); E, penicillate conidiophore; F, subverticillate conidiophore; G, conidia (ATCC 38571) and H, asci and ascospores (redrawn from Rossman, 1983).

*Cultures examined*: Australia: Queensland, fruit of a rain forest tree, Shipton, 1973, ATCC 38571 (type culture of teleomorph). Brazil: Aracruz nursery, *Eucalyptus* cuttings, A. C. Alfenas, PPRI 4450. New Zealand: *Pinus pinea*, H. Boesewinkel, 1982, ATCC 44816 (type culture of anamorph).

**Cylindrocladiella lageniformis** Crous, Wingfield & Alfenas, sp. nov.

*Vesiculae* lageniformes vel ovoideae, (9)–12–(18) µm latae. *Stipites* inramosi, in mediis conidiophoris, cum uno septo basilari, (63)–80–(120) µm longi. *Conidiophora* penicillata, primi rami inseptati vel uniseptati, (10·0)–14·0–(20·0) × (2·5)–3·0–(3·5) µm, rami secundarii inseptati, (8·0)–11·0–(15·0) × (2·0)–2·5–(3·0) µm, phialides doliiformes vel reniformes vel cymbiformes, (8·0)–10·0–(14·0) × (2·0)–2·5–(3·0) µm cum collariculis. *Conidiophora* subverticillata pauca vel satis numerosa. *Conidia* inseptata vel uniseptata, (9·0)–11·5–(15·0) × (1·5)–1·8–(2·0) µm. *Temperaturae* ad crescendum necessariae; minima temperatura plus quam 5°; maxima temperatura minor quam 35°; optima temperatura 25°. Haec est species et temperaturae minoris et temperaturae maioris, cum maiore sporulatione in mycelio aerio. Color coloniae (ad fundum), 15″i sayal brunneus (Rayner, 1970), 5D6 aureo-brunneus (Kornerup & Wanscher, 1967). *Chlamydosporae* prolixae, catenatim dispositae.

Holotypus PREM 50927 ex *Eucalyptus* spp., Aracruz, ES, Brazil, A. C. Alfenas.

***Morphology.*** *Vesicles* lageniform to ovoid (Figs 2, 16), (9)–12–(18) µm wide. Stipes unbranched, in the middle of conidiophore, having one basal septum, (63)–80–(120) µm long. *Penicillate conidiophores*, primary branches 0–(1)-septate, (10·0)–14·0–(20·0) × (2·5)–3·0–(3·5) µm, secondary branches non-septate, (8·0)–11·0–(15·0) × (2·0)–2·5–(3·0) µm phialides doliiform to reniform to cymbiform, (8·0)–10·0–(14·0) × (2·0)–2·5–(3·0) µm with collarettes. *Subverticillate conidiophores* sparse to medium in number. *Conidia* (0)–1-septate, (9·0)–11·5–(15·0) × (1·5)–1·8–(2·0) µm. *Colony colour* (reverse), 15″i sayal brown (Rayner, 1970), 5D6 golden brown (Kornerup & Wanscher, 1967). *Chlamydospores* extensive, arranged in chains.

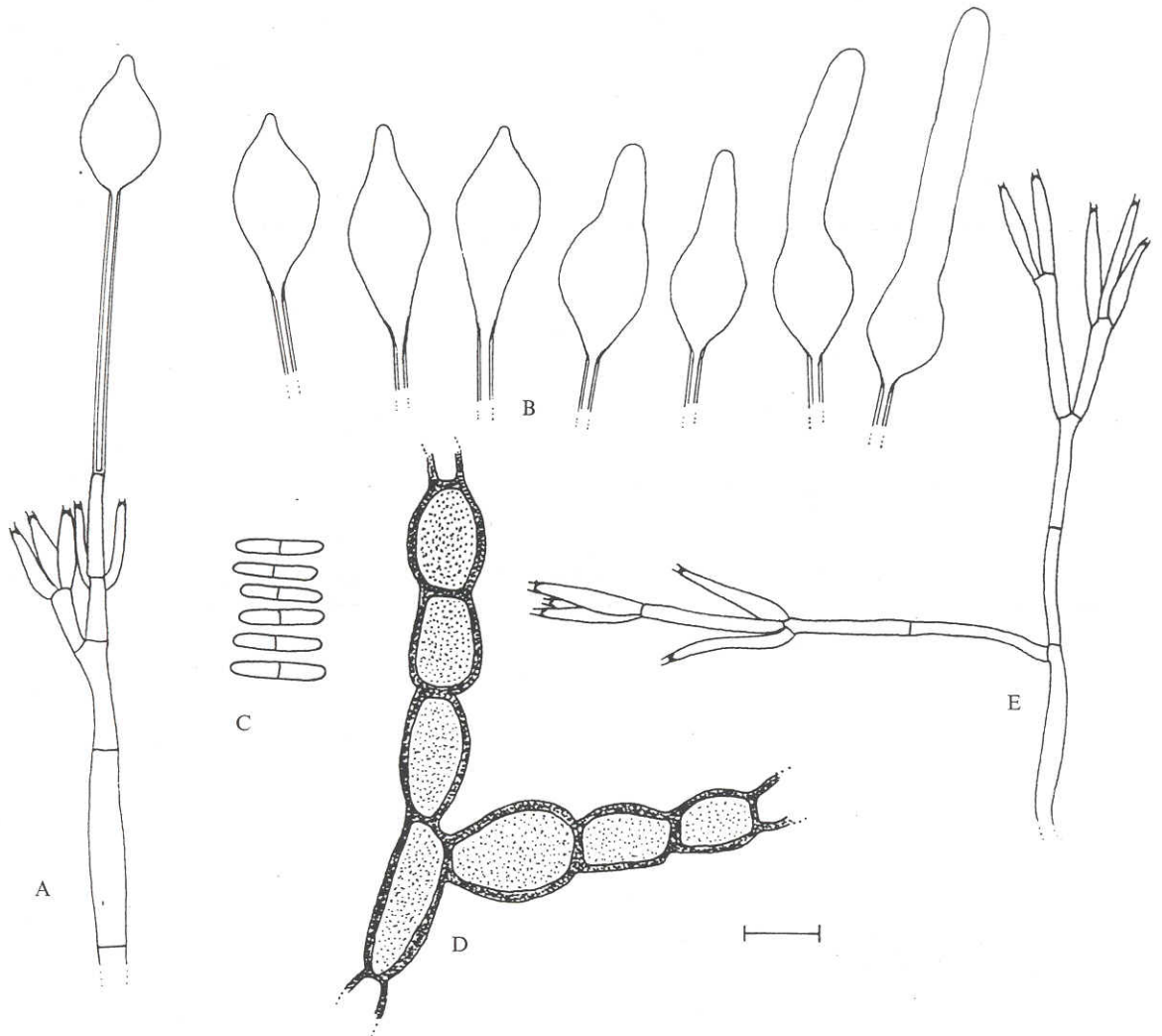



**Fig. 16. A–E.** *Cylindrocladiella lageniformis*. Bar = 10 µm. A, Penicillate conidiophore; B, vesicles; C, conidia; D, chlamydospores and E, subverticillate conidiophore (PPRI 4449, type).

***Temperature requirements.*** Minimum above 5°; maximum below 35°; optimum 25°. This is both a low- and high-temperature species (Fig. 10), with extensive sporulation on aerial mycelium.

***Disease.*** Isolated from stems of dying *Eucalyptus* cuttings.

***Hosts.*** *Eucalyptus* sp.

***Geographical distribution.*** Brazil.

***Notes.*** This species is primarily distinguished from *C. camelliae* and *C. infestans* by its lageniform, wide vesicles. A diffuse reddish pigment can also be observed in the growth medium. Although subverticillate conidiophores are present, they occur less commonly than in *C. camelliae* and *C. infestans*. Furthermore, they also frequently branch at more than one level, a characteristic previously ascribed only to *C. infestans*.

*Specimen examined*: Brazil: ES, Aracruz nursery, *Eucalyptus* cuttings, A. C. Alfenas, PREM 50927, holotype.

*Culture examined*: Brazil: ES, Aracruz nursery, *Eucalyptus* cuttings, A. C. Alfenas, PPRI 4449, CBS 338.92 (single conidial isolate, type culture).

**Cylindrocladiella novae-zelandiae** (Boesew.) Boesewinkel, *Can. J. Bot.* **60**: 2289 (1982).

*Cylindrocladium novae-zelandiae* Boesewinkel, *Trans. Br. mycol. Soc.* **76**: 341 (1981).

***Morphology.*** *Vesicles* irregularly lanceolate (Figs 6, 17), (3·5)–5·0–(9·0) µm wide. *Stipes* unbranched, in middle of conidiophore, having one basal septum, (95)–103–(125) µm long. *Penicillate conidiophores*, primary branches 0–(1)–septate, (9·0)–11·5–(16·0) × (3·0)–3·5 µm, secondary branches non-septate, (8·0)–10·0–(15·0) × (3·0)–3·5 µm, phialides doliiform to reniform, (8·0)–10·5–(15·0) × (3·0)–3·5–(4·0) µm, collarettes present in moderate numbers (on less than 50% of the phialides). *Subverticillate conidiophores* rare to absent. *Conidia* (0)–1-septate, (11·3)–14·5–(25·0) × (1·9)–2·5–(3·2) µm. *Colony colour* (reverse), 17D light orange-yellow (Rayner, 1970),

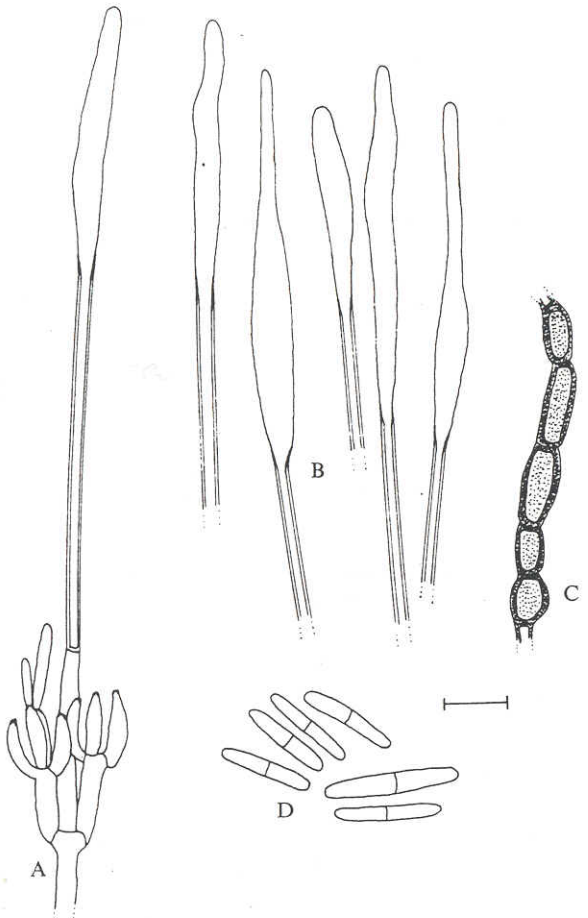



**Fig. 17. A–D.** *Cylindrocladiella novae-zelandiae.* Bar = 10 µm. A, Penicillate conidiophore; B, vesicles; C, chlamydospores and D, conidia (ATCC 44815, type).

4A5–4B5 butter yellow to corn (Kornerup & Wanscher, 1967). *Chlamydospores* few, arranged in chains.

***Temperature requirements.*** Minimum below 5°; maximum below 30°; optimum 20°. This is a low-temperature species (Fig. 11), with medium sporulation on aerial mycelium.

***Disease.*** Isolated from roots of *Rhododendron indicum* Sweet (Boesewinkel, 1981).

***Host.*** *R. indicum* (Boesewinkel, 1981).
***Geographical distribution.*** New Zealand (Boesewinkel, 1981).

***Notes.*** This species is known from one collection only (Boesewinkel, 1981). The most distinct criteria distinguishing this species from others are its very slow growth rate, sparse chlamydospore formation, irregular lanceolate vesicles, and penicillate conidiophores.

*Culture examined*: New Zealand: *Rhododendron indicum*, H. Boesewinkel, 1981, ATCC 44815 (type culture).

**Cylindrocladiella parva** (Anderson) Boesewinkel, *Can. J. Bot.* **60**: 2289 (1982).

*Cylindrocladium parvum* Anderson, *Bull. Massey Agric. Exp. Stn* **183**: 37 (1918).

*Teleomorph.* None described, but Boesewinkel (1982) refers to an isolate from *Rheum rhaponticum* L. that formed perithecia.

***Morphology.*** *Vesicles* clavate to spathulate or pyriform (Figs 1, 18), (4·0)–5·5–(8·0) µm wide. *Stipes* unbranched, in middle of conidiophore, having one basal septum, (65)–75–(90) µm long. *Penicillate conidiophores*, primary branches non-septate (13·0)–18·0–(24·0) × (3·0)–3·5–(4·0) µm, secondary branches non-septate (10·0)–15·0–(20·0) × (2·5)–3·0–(3·5) µm, phialides doliiform to cymbiform, (9·0)–14·0–(17·0) × (3·0)–3·5–4·5 µm, collarettes rare to absent. *Subverticillate conidiophores* rare to absent. *Conidia* (0)–1-septate, (13·5)–17·0–(19·5) × (2·0)–2·5–(3·0) µm. *Colony colour* (reverse) 17″I-19″B tawny-olive to chamois (Rayner, 1970), 5E6–4B6 mustard brown to amber yellow (Kornerup & Wanscher, 1967). *Chlamydospores* extensive, in chains.

***Temperature requirements.*** Minimum below 5°; maximum below 33°; optimum 25°. This is a low-temperature species (Fig. 7), with medium sporulation on aerial mycelium.

***Disease.*** Sobers & Alfieri (1972) regarded all their isolates as saprotrophic, but Sharma & Mohanan (1982) (identification unconfirmed) found *C. parva* causing damping-off and seedling blight on *Eucalyptus* spp.

***Hosts.*** *Annona cherimola* Mill., *Camellia japonica* L., *Eucalyptus* spp., *Macadamia integrifolia* Maid. & Betche, *Pelargonium* sp., *Persea americana* Mill., *Phaseolus vulgaris* L., *Pinus contorta* Douglas: Loud., *P. radiata* D. Don, *Psidium gaujava* L., *Rheum rhaponticum*, *Rosa* sp., *Telopea speciosissima* R. Br., *Spondias mangifera* Willd., *Vitis vinifera* L., *Xanthosoma sagittifolium* (L.) Schott. (Boedijn & Reitsma, 1950; Darvas, Scott & Kotze, 1978; Roth & Griffin, 1981; Mandal & Dasgupta, 1983; Mohanan & Sharma, 1986).

***Geographical distribution.*** Australia, Brazil, Costa Rica, Europe, Hong Kong, India, Japan, Java, Malawi, Massachusetts, Hawaii and Florida (U.S.A.), Mauritius, New Zealand, South Africa, Great Britain, West Indies (Boedijn & Reitsma, 1950; Sobers & Alfieri, 1972; Sharma & Mohanan, 1986; Boesewinkel, 1981; Crous, Phillips & Wingfield, 1991).

***Notes.*** Anderson (1918) did not lodge any type material, nor did he illustrate or describe the nature of the vesicle of *C. parva*. These factors contributed to the confusion surrounding the morphology of *C. parva*, eventually leading to numerous incorrect reports in the literature (Boesewinkel, 1982).

In the original description, Anderson (1918) described conidia of *C. parva* as being 16·8 × 2·5 µm on PDA. He also stated that the fungus is probably saprobic, and that conidiophores are 130 µm long. Boedijn & Reitsma (1950) described their collection of *C. parva* as having 'club-like' vesicles. Illustrations by Matsushima (1971) suggest that this author was unsure of the morphology of *C. parva*. Domsch, Gams & Anderson (1980) followed Boedijn & Reitsma, and

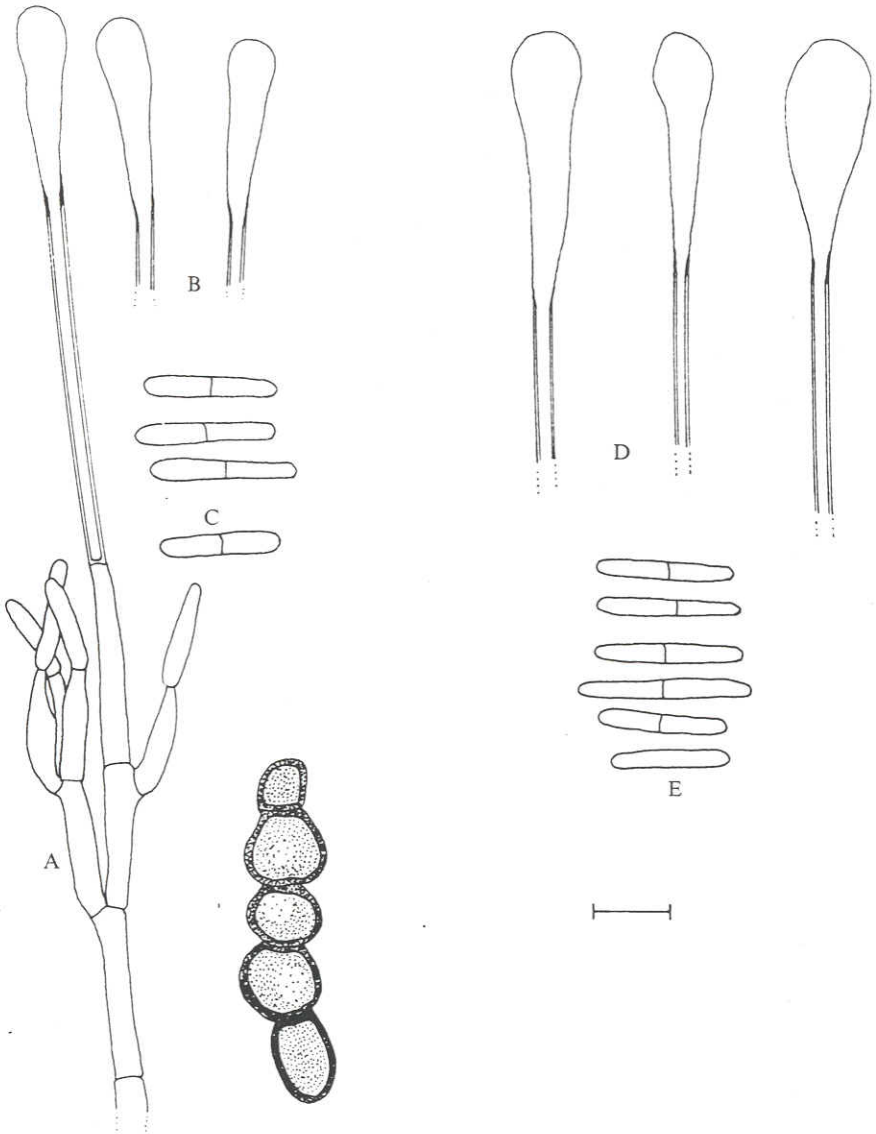
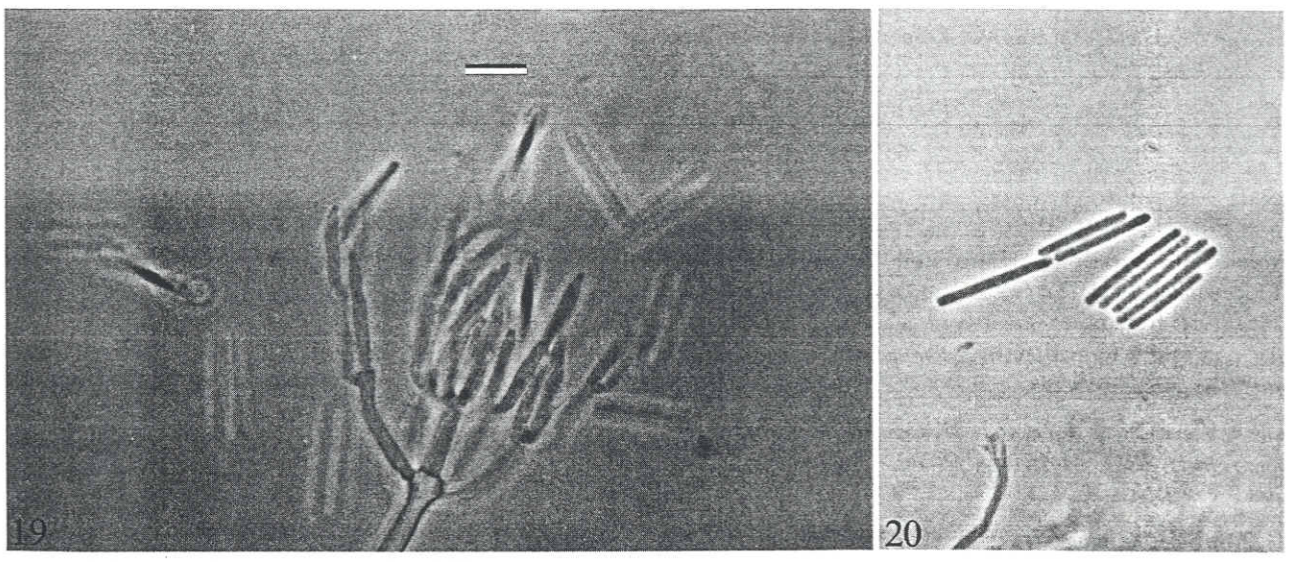



**Fig. 18. A–E.** *Cylindrocladiella parva*. Bar = 10 µm. A, conidiophore and chlamydospores; B, vesicles; C, conidia (ATCC 28272, neotype); D, vesicles and E, conidia (PPRI 3999).




**Figs 19–20.** *Gliocladiopsis tenuis*. Bar = 10 µm. **Fig. 19.** Penicillate conidiophore. **Fig. 20.** Cylindrical 1-septate conidia.

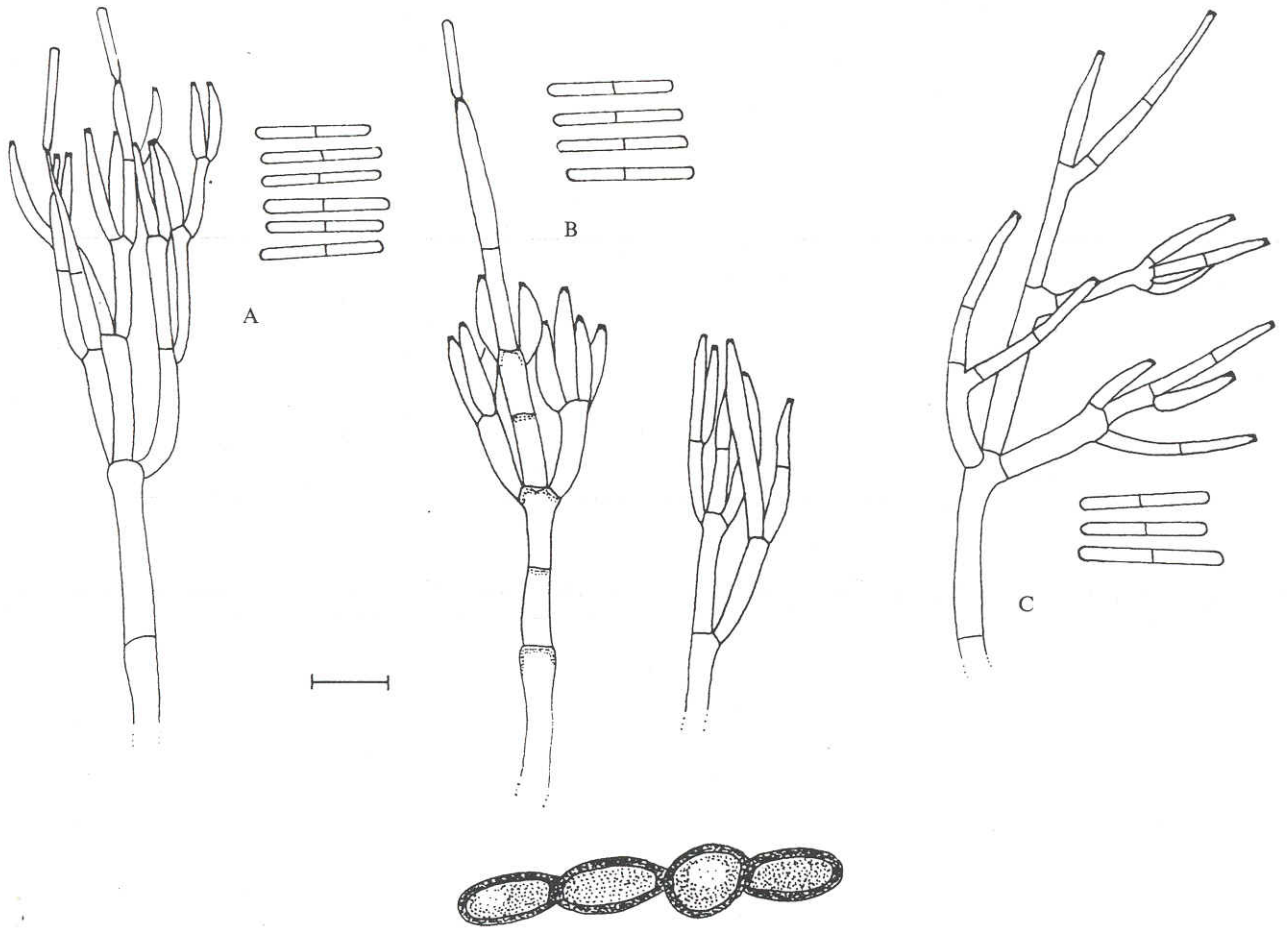



**Fig. 21. A–C.** Conidiophores, conidia and chlamydospores of *Gliocladiopsis tenuis*. Bar = 10 µm. A (IMI 68205, type), B (IMI 300597) and C (IMI 137986).

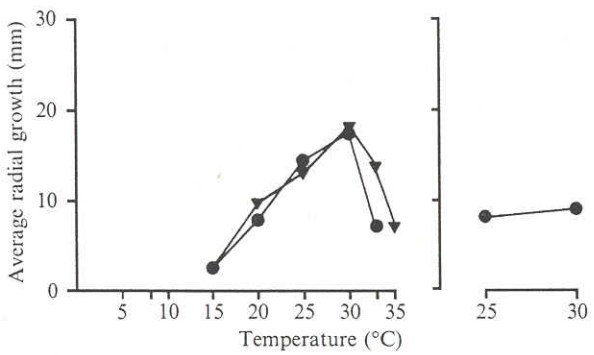



**Fig. 22.** Average radial colony growth (mm) of *Gliocladiopsis tenuis* on MEA at various temperatures after 6 d (left) and 3 d (right) respectively. (●), IMI 68205; (▼), IMI 300597.

referred to a swollen vesicle. Boesewinkel (1982) referred to numerous wrongly identified collections. Boesewinkel examined Boedijn & Reitsma's isolate (CBS 191.50) (Boedijn & Reitsma, 1950) from *Arenga pinnata* and found it representative of *C. camelliae*, and not *C. parva*.

The only additional criteria available for *C. parva* relate to its appearance in culture (Anderson, 1918). On potato agar, cultures were described as 'perfectly white' and after 3 wk had 'practically no colour – possibly a faint buff'. On sugar potato agar, cultural colour was 'wood brown' after 2 wk, with patches of 'army brown', showing chlamydospores. Conidial dimensions, the numerous chlamydospores produced on sugar potato agar, and its saprobic nature are valuable criteria in the original description.

A comparison of a culture lodged by Boesewinkel as *C. parva* (ATCC 28272) and a similar South African collection (PPRI 3999) show them to be brownish in colour on PDA and MEA after 7 d. This is due to the extensive production of chlamydospores in culture. This, and the conidial dimensions mentioned in the original description, lead us to conclude that isolates ATCC 28272 and PPRI 3999 are representative of *C. parva*.

Due to the absence of a type specimen, a neotype has been designated for *C. parva* (ATCC 28272) (dried specimen PREM 50929). *C. parva* is further characterized by being a fast-growing, low-temperature species (Fig. 7), which has only penicillate conidiophores.

*Specimens examined*: Great Britain: wooden poles, C. Booth, 1963, IMI 101972 (as *C. dixi*); *Pinus contorta*, Andrews, 1983, IMI 281445 (as *C. pini*).

*Cultures examined*: New Zealand: *Telopea speciosissima*, H. Boesewinkel, 1974, ATCC 28272, PREM 50929 (neotype). South Africa: Cape Province, Grabouw nursery, *P. radiata* roots, P. W. Crous, 29 Feb. 1990, PPRI 3999, IMI 351146.

**Gliocladiopsis** Saksena, *Mycologia* **46**: 662 (1954).

*Conidiophores* hyaline, single, penicillate, quaternary branches present. *Phialides* terminal, hyaline, in whorls of up to six per branch, with obvious collarettes. *Stipe* and vesicle absent. *Conidia* hyaline, cylindrical with obtuse ends, uniform in width, with no swollen ends after 2 wk on CLA; borne in yellow masses on conidiophores. *Chlamydospores* occur in chains. Colony growth on MEA is smooth and slimy. However, fluffy aerial mycelium can also be present. No teleomorph known.

*Type species*: *G. sagariensis* Saksena.

Saksena (1954) erected this monotypic genus, with type species *G. sagariensis* Saksena. It was mainly distinguished from *Cylindrocladium* by the absence of a stipe extension and terminal vesicle. Agnihothrudu (1959) examined the type cultures of *Cylindrocarpon tenue* Bugn. (Bugnicourt, 1939) and *G. sagariensis*. He concluded that the two fungi were the same. Agnihothrudu (1959) argued that *G. sagariensis* was a *Cylindrocarpon* sp., because it had the same branching pattern and phialide arrangement as *Cylindrocarpon gracile* Bugn. described by Bugnicourt (1939). Boesewinkel (1981) showed, however, that *Cylindrocarpon gracile* was in fact a new species of *Cylindrocladium*, for which he erected the name *C. gracile* (Bugn.) Boesewinkel.

Booth (1966) did not mention the synonymy of *G. sagariensis* with *C. tenue* in his review of *Cylindrocarpon* Wollenw., and therefore did not treat *Gliocladiopsis*. Barron (1968) contradicted Agnihothrudu (1959), by listing *Gliocladiopsis* as a synonym for *Cylindrocladium*. Agnihothrudu's treatment of *G. sagariensis* as a synonym of *C. tenue* was, however, accepted by Subramanian (1971).

The present study indicates that *Gliocladiopsis sagariensis* is synonymous with *Cylindrocarpon tenue*. Furthermore, the conidiophore branching pattern, as well as the absence of stipes, distinguishes this species from *Cylindrocladiella* and *Cylindrocladium*. Conidiophore branches of *Gliocladiopsis* are also penicillately arranged, unlike those of *Cylindrocarpon* spp. The genus *Gliocladiopsis* should therefore be retained, as it accommodates species that do not fit into any of the other three genera discussed above.

This study has shown that the type of *C. tenue* closely resembles *G. sagariensis*, and must be placed in *Gliocladiopsis*. The type specimen of *G. sagariensis* (lodged at the New Delhi Type Culture Collection, India) could not be obtained to confirm its conspecificity with *C. tenue*. The species *C. tenue* must, however, be placed in *Gliocladiopsis* as a new combination:

**Gliocladiopsis tenuis** (Bugnicourt) Crous & Wingfield, comb. nov.

*Cylindrocarpon tenue* Bugn., *Encycl. Mycol.* **11**: 178 (1939).

*Gliocladiopsis sagariensis* Saksena, *Mycologia* **46**: 663 (1954).

***Morphology.*** *Vesicles* and *stipes* absent. *Conidiophores* penicillate (Figs 19–21), primary branches non-septate, (9·0)–16·5–(23·0) × (3·0)–3·5–(5·0) µm, secondary branches non-septate, (10·0)–13·5–(18·0) × (2·5)–3·5–(4·0) µm, tertiary branches non-septate, (9·0)–12·0–(14·0) × (2·5)–3·0–(3·5) µm, quaternary branches rare to absent, non-septate, (9·0)–10·0–(12·0) × 2·5–(3·0) µm, phialides doliiform to cymbiform to cylindrical, (10·0)–16·5–(25·0) × 2·5–(3·0) µm, arranged in terminal whorls of up to 7 per branch, with central phialide markedly longer than the rest. Collarettes present in moderate numbers (on nearly 50% of the phialides). Central axis of conidiophore terminating in a fertile, elongated phialide, frequently extending above the phialide whorls situated on the other branches of the conidiophore. *Conidia* (0)–1-septate, (16·0)–16·5–(20·0) × 1·5–(2·0) µm. *Colony colour* (reverse), 15″I sayal brown (Rayner, 1970), 5D6–5D7 oak brown to golden brown (Kornerup & Wanscher, 1967). *Chlamydospores* extensive, in clearly delimited, mostly unbranched chains.

***Temperature requirements.*** Minimum above 10°; maximum above 35°; optimum 30°. This is a high-temperature species (Fig. 22), with slight sporulation on aerial mycelium.

***Habitat.*** Isolated from soil (Saksena, 1954), and roots of tea bushes (Agnihothrudu, 1959).

***Hosts.*** *Indigofera* sp.; *Psidium guajava*; *Shorea robusta* Roth. Roots of *Camelliae sinensis* (Agnihothrudu, 1959).

***Geographical distribution.*** India, South-East Asia (Indo-China) (Bugnicourt, 1939; Saksena, 1954; Agnihothrudu, 1959).

***Notes.*** In addition to differences already discussed, *G. tenuis* is further distinguished from *Cylindrocladiella* spp. by having up to six phialides per branch, surrounding a central, elongated, cylindrical, tapering phialide. Under the conditions used in this study, *G. tenuis* also had conidiophores with up to four branches, which has never been observed in *Cylindrocladiella*.

In dealing with *Gliocladiopsis*, mention must also be made of *Cylindrocladium intermedium* Matsushima (1971). This species was described with no stipe or vesicle. This, together with conidial dimensions and the fact that conidia form in yellow masses, suggests that this collection represents another species of *Gliocladiopsis*. Attempts to obtain the type specimen (MFC 2678, lodged in Matsushima's personal herbarium) were unsuccessful, and therefore this species cannot be treated further.

*Specimens examined*: India: *G. sagariensis* from soil, S. B. Saksena, 1952, New Delhi, Indian type collection (type not examined); *Shorea robusta*, 1968, IMI 137986. Indo-China: *Indigofera* sp., F. Bugnicourt, IMI 68205 (ex type *C. tenue*).

*Cultures examined*: Indo-China: *Indigofera* sp., F. Bugnicourt (Paris no. 540) (IMI 68205) (type *C. tenue*). India: Warangal, *Psidium guajava*, 1986, IMI 300597.

**Acontiopsis** Negru, *Communicarile Aca. Repub. Pop. Rom.* **7**: 839 (1961).

*Conidiophores* hyaline, single, penicillate, tertiary branches present. *Phialides* hyaline, terminal, in whorls of three to five per branch. *Stipe* illustrated as septate, terminating in a hyaline vesicle of characteristic shape. *Conidia* non-septate, hyaline, cylindrical with obtuse ends, arranged in cylindrical mu-

cilaginous conidial cluster. *Chlamydospores* in chains. No teleomorph known.

*Type species*: *A. crataegi* Negru.

*Acontiopsis* Negru, with type species *A. crataegi* Negru, was erected in 1961 (Negru, 1961). Kendrick & Carmichael (1973) placed the genus in synonymy with the earlier *Cylindrocladium*. Peerally (1991) subsequently made the new combination *C. crataegi* (Negru) Peerally.

An examination of the original description of *Acontiopsis crataegi* (Negru, 1961), has raised several questions. No type material was designated for *A. crataegi* and the name is thus invalidly published. Dr O. Constantinescu (curator of BUCM herbarium, Romania, 1957–81) has informed us that A. Negru maintained a private herbarium, and that it would therefore be impossible to obtain the type material of *A. crataegi*.

In an attempt to determine whether *Acontiopsis* could be a synonym of *Cylindrocladium* (Kendrick & Carmichael, 1973), or an earlier name for *Cylindrocladiella*, only the description and illustration were available for study. *A. crataegi* was described as having small, aseptate conidia 14–18 × 2–3 µm, with chlamydospores arranged in chains, thus inferring relatedness to *Cylindrocladiella*. However, the stipes were illustrated as being septate, suggesting a similarity with *Cylindrocladium*. It is possible that conidial septation was overlooked in the original description of *Acontiopsis*, and this may be an earlier name for *Cylindrocladiella*. Only Negru (1961) has ever examined the material of this genus, and at this stage we can make no definite statement regarding its status.

### Key to related anamorph genera

1. Conidia hyaline, 0–multi-septate, cylindrical with obtuse ends, in hyaline slimy masses; stipe present . . . . . 2
1. Conidia hyaline, 0–1-septate, uniform cylindrical with obtuse ends, mostly in yellowish slimy masses; stipe extension absent . . . . . *Gliocladiopsis*
1. Conidia hyaline, 1–multi-septate, straight or fusoid, attenuating to rounded ends, in hyaline to yellowish slimy masses; stipe extension absent . . . . . *Cylindrocarpon*
   2. Stipe extension septate; branched microsclerotia common on MEA; cultures not slimy on MEA; phialide collarettes absent on CLA; ascocarp with warty outer layer . . . . . *Cylindrocladium*
   2. Stipe extension non-septate; microsclerotia uncommon and cultures mostly slimy on MEA; phialide collarettes present on CLA; ascocarp with smooth outer layer . . . . . *Cylindrocladiella*

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