Nectria serpens sp. nov. and its hyphomycetous anamorph
Xenocyrtindrocladium gen. nov.

CONY DECOCK1, GRÉGOIRE L. HENNEBERT1 AND PEDRO W. CROUS2
1 Mycthèque de l'Université Catholique de Louvain, Faculté des Sciences Agronomiques, 1348 Louvain-la-Neuve, Belgium
2 Department of Plant Pathology, University of Stellenbosch, P. Bag X1, Matieland 7602, South Africa

A homothallic species of Nectria producing a Cylindrocladium-like anamorph was collected from bark of a fallen tree in the Amazonian forest in Ecuador. The anamorph, which is placed in a new genus, Xenocyrtindrocladium, is characterized by forming straight, cylindrical, 1-septate conidia borne on perithecoid conidiophores with coiled, avesiculate stipe extensions. The teleomorph, which is best accommodated in Nectria, is distinct in forming yellow-orange perithecia with red ostiolar regions, ellipsoidal, smooth, hyaline, 1-septate ascospores, and long-stalked, cylindrical asci with apical discharge mechanisms. Both the teleomorph and anamorph states are newly described as Nectria serpens and Xenocyrtindrocladium serpens.

In the Hypocreales Nectria (Fr.) Fr. includes morphologically diverse fungi that have superficial, brightly coloured, uniloculate ascomata and phialidic anamorphs. Rossman (1979, 1983) defined additional anatomical and morphological characters of both teleomorph and anamorph states to segregate Ophioplectria Sacc. and Calonectria De Not. from Nectria. She furthermore restricted Calonectria to species having warty ascocarps, that turn red to blood-red in 3% KOH, have darkened stromatic bases, and Cylindrocladium Morgan anamorphs. Rossman (1989) restricted Nectria, on the basis of its type species N. cinnabarina (Tode: Fr.) Fr., to only those species that are closely related to N. cinnabarina and belong to the N. cinnabarina-group. Several other groups of nectriaceous species, which based on their teleomorph and anamorph features are still placed in Nectria sensu lato, require a better generic position (Rossman 1993). These include the Nectria haematococca-group, N. rigidisepula-group, N. flammans-group, N. subg. Dialonectria Sacc., all with Fusarium Link anamorphs, and the N. radicula-group with Cylindrocarpon Wollenw. anamorphs. Several nectriaceous species have since been clustered in separate groups based on their teleomorph and anamorph characteristics (Rossman, 1989, 1993).

Cylindrocladium, initially revised by Boedijn & Reitsma (1950), has subsequently been treated by Peeraly (1991), and recently by Crous & Wingfield (1994), who redifined it as having huyline, pericelar conidiophores, giving rise to whorls of phialides bearing cylindrical, straight or curved, 1–9-septate conidia. The stipes of the conidiophores extend above the phialides, and terminate in thin-walled vesicles of characteristic shape. All teleomorphs presently known for Cylindrocladium are placed in Calonectria. Several species are known also to produce a microconidial anamorph (Crous & Wingfield, 1994).

During the British Mycological Society's expedition in the Cuyabeno rainforest, Ecuador, in July 1993, a nectriaceous species associated to a Cylindrocladium-like anamorph was collected by G.L. Hennebert from the bark of a dead tree trunk (GLH 2504 F and GLH 2504 G). This fungus appears to be undescribed. It is here described and named as new.

MATERIALS AND METHODS

The fungus was collected from the bark of a fallen tree in the Tierra Firme Forest, near PUCE Research Station, north-east of Laguna Grande, on the northern affluent of the Rio Cuyabeno, latitude 0°, longitude 76°W, in the Cuyabeno Reserve, north-eastern Ecuador. Isolation of the associated Cylindrocladium-like anamorph was performed from single conidia under a stereo microscope immediately after collection. Single-conidial isolates were cultured on 2% malt extract agar (MEA) (Oxoid), plated onto carnation-leaf agar (CLA) (Crous, Phillips & Wingfield, 1992), incubated at 25 °C under red 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 50 observations, and extremes are given in parentheses.

Scanning electron microscopy (SEM) was used to observe the nature of the stipe and terminal vesicle. 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 Jeol JSM 6100 scanning electron microscope.
RESULTS AND DESCRIPTION OF SPECIES

In a study comparing the *Cylindrocladium* spp. with 3-septate conidia and ovoid-like vesicles (Crous et al., 1993), it was stated that all species of *Cylindrocladium* have stipe extensions terminating in vesicles of characteristic shape. Based on several features including its characteristic stipe morphology and *Nectria* teleomorph, *Cylindrocladiella Boosew*. can easily be distinguished from *Cylindrocladium* (Samuels et al., 1991; Crous & Wingfield, 1993). Furthermore, the absence of stipe extensions and the characteristic branching habit of its conidiophores also separated *Gliocladiopsis* S. B. Saksena from *Cylindrocladiella*.

Among the 20 species of *Cylindrocladium* presently recognized (Crous & Wingfield, 1994; Victor et al., 1997; P. W. Crous, unpublished), no species has yet been linked to a teleomorph other than *Calonectria*. The *Nectria* teleomorph associated with the present *Cylindrocladiella*-like collection suggests that this holomorph cannot be accommodated in the *Calonectria* complex, which represents a well-defined ana-
morph/teleomorph relationship. Furthermore, the absence of characteristic terminal vesicles, as well as the coiled stipe

Figs 1-5. *Nectria serpens*. Fig. 1. Yellow perithecia with dark red base and red ostiolar region (bar, 20 μm). Fig. 2. Vertical section through perithecia, showing various wall layers. Fig. 3. Ellipsoidal 1-septate ascospores. Fig. 4. Ostiolar region with periphyses. Fig. 5. Long-stemmed, cylindrical ascus with apical discharge mechanism (bars, 10 μm).
extensions, suggests that the anamorph cannot be accommodated in *Cylindrocladium*. As none of the genera with septate, cylindrical conidia, penicillate conidiophores and stipe extensions is suitable for this collection, it is accommodated in a new hyphomycete genus proposed below.

*Xenocylindrocladium* Decock, Hennebert & Crous gen. nov.

(Figs 6, 8–11)

Teleomorph: *Nectria*.

Cylindrocladion similis, sed dissimilis per sterlem stipitam extensionem non vesiculatum, spiris tortam et teleomorphosis e Nectriae genere.

Similar to *Cylindrocladium*, but distinct in having coiled stipe extensions devoid of vesicles, and a *Nectria* teleomorph.

_Type species:* *Xenocylindrocladium serpens* Decock, Hennebert & Crous.

Samuels & Seifert (1987) compared the straight conidia of the *Cylindrocarpon* anamorphs of the *Nectria radicicola*-group to those of *Cylindrocladium*. Samuels & Brayford (1990) further discussed the similarities in perithecial anatomy and morphology of the *N. radicicola*-group to that of *Calonectria*. Although these similarities exist, species of *Calonectria* have a very conserved ascal morphology, which is distinct from that of the *N. radicicola*-group. Although the *N. radicicola*-group resembles *Calonectria* in perithecial anatomy and general cultural characteristics, it is distinct with regard to the flat asciion scars on the conidia, shape of its microconidia, and conidiophore branching patterns. The *N. radicicola*-group is furthermore also distinct from the other *Nectria* groups with *Cylindrocarpon* anamorphs.

Perithecia associated with *Xenocylindrocladium* are not as warted as those of the *N. radicicola*-group or *Calonectria*. The perithecial morphology is, however, closer to that of the *N. radicicola*-group than *Calonectria*, while the anamorph is more similar to *Cylindrocladium* than *Cylindrocarpon*. Based on the anamorphs, therefore, it is possible that our collection represents yet another group in this complex of nectriaceous fungi.

*Nectria serpens* Decock, Hennebert & Crous sp. nov.

(Figs 1–5, 7)

Anamorph: *Xenocylindrocladium serpens* Decock, Hennebert & Crous sp. anam. nov.

(Figs 6, 8–11)

_Perithecia_ superficialia, solitary vel aggregata, globosa ad pyriformia, 400–450 × 350–400 μm, verrucosa, lutea usque ad luteo-aurea, cum rubro papillato ostiolo et umbroso-rubra stromatica 60–160 μm lata basi, pariete et ostiolo rubris in 3% KOH, externa pariete 100 μm, textura globulosa, crasso tunicata, media pariete textura angularis, compressa, interna pariete 10 μm hyalina, textura prismatica. _Periphyses_ cylindraceae, 30 × 3 μm. _Asci_ unitunicati, octospori, hyalini, cylindrici, inflati in maturitate, cum elongato basi et placentato apice refracto annello praedilto, 70–120 × 7–11 μm. _Ascospores_ in superiore parte asci, hyalinae, ellipticae, leves, medio unisepitaeae, 8–25 × 4–6 μm, medio 15.5 × 4.5 μm. _Conidiophori_ penicillati, stipite septato, hyalino, erecto, cum sinuoso vel helico, cylindrico, 140–250 μm longo, 3–4 μm basali, 2–3 μm apicaliter lato. Primis ramos non septatis, 20 × 3–5 μm, secundis ramos verticillatis 15 × 3 μm. _Pillaides_ doliformes vel reniformes, curvatae, hyalinae, 10–15 × 3–4 μm. Conidia cylindrica, hyalina, recta, apice rotundato, unisepulata, 24–36 × 2.5–3.5 μm, medio 30 × 3 μm. _Chlamydosporae_ in cultura productae numerosae.

_Perithecia on CLA in vitro, superficial, solitary or in clusters of 2–3, globose to subglobose, 400–450 μm high, 350–400 μm wide, warted, yellow, becoming yellow-orange, with a red, papillate ostiolar region and a dark red stromatic base, 60–160 μm wide; perithecial body becoming light red in 3% KOH, ostiolar region red, and stromatic base dark red. Perithelial wall consisting of two regions: outside layer of thick-walled texture globulosa, up to 100 μm wide, cells 16–28 μm wide, becoming darkened, compressed, texture angularis towards the centrum; hymenium layer of texture prismatica, hyaline, up to 10 μm wide. Ostiolar peripheries tubular with rounded ends, up to 3 μm wide and 30 μm long. Asci unitunicate, 8-spored, cylindrical with long basal stalks, a flattened apex, and a refractive apical apparatus (visible in immature and mature asci), 70–120 × 7–11 μm; asci swelling slightly in apical part when ascospores are mature. Ascospores aggregated in upper third of the ascus, hyaline, broadly to narrowly ellipsoidal, smooth, with a granular content. (8–)15.5–(25) × (4–)4.5–(6) μm, medianly 1-septate, becoming constricted at the septum, and developing up to 2 septa with age.

Figs 6, 7. *Nectria serpens* and its anamorph *Xenocylindrocladium serpens*. Fig. 6. Penicillate conidiophore, 1-septate conidia and coiled or variously curved vesicles. Fig. 7. Cylindrical asci and 1-septate, ellipsoidal ascospores (bars, 10 μm).

*Specimen examined*: Ecuador, Prov. Sucumbios, Reserva de Producción Faunística, Cuyabeno, Tierra Firme, bark of a fallen trunk, G. L. Hennebert, 2504 G, Jul. 1993, MUCI 39315 (Holotype) in MUCI herbarium, living culture preserved at MUCI (MUCI 39315) and STE-U 1144.

*Nectria* serpens is distinguishable from species of *Calonectria* based on its cylindrical asci, refractive apical ascal rings, and *Xenocylindrocladium* anamorph. Within *Nectria* it is similar to *N. venusta* Syd., but has smaller ascospores (8–25 × 4–6 μm) than those of *N. venusta* (17–28 × 6–9.5 μm) (Sydow, 1930). Within *Calonectria*, it is also easily separable from known species based on its smaller ascospore dimensions and ascus morphology.

*Calonectria* should not be expanded to include fungi with anamorphs other than *Cylindrocladium sensu stricto*. If more species with a perithecial anatomy, ascus morphology and anamorph similar to *N. serpens* are collected, further attention can be given to elucidate the relationship between *Calonectria*, the *N. radicicola*-group and *N. serpens*.

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REFERENCES


