

TAXONOMY

***Amphilogia* gen. nov. for *Cryphonectria*-like fungi from *Elaeocarpus* spp. in New Zealand and Sri Lanka**

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The ascomycete genera *Cryphonectria* and *Endothia* are closely related members of Diaporthales. Recent DNA sequence comparisons have shown that isolates from *Elaeocarpus* spp. in New Zealand, previously identified as *Cryphonectria radicalis* and *Cryphonectria gyrosa*, represent a phylogenetic group distinct from those including other species of *Cryphonectria* and *Endothia*. *Cryphonectria gyrosa* applies to a species that occurs on *Elaeocarpus glandulifer* in Sri Lanka, the same host genus but a different species from which the New Zealand collections were made. The aim of this study was to provide a name for the fungi residing in the phylogenetic group from New Zealand. Morphological characters that define these fungi include superficial conical conidiomata, conidia of variable size, and ascospores with one to three septa. These characteristics are not found in other species of *Cryphonectria*. We also recognise a second species in the group from New Zealand that has distinctly larger ascospores. Herbarium specimens of *C. gyrosa* exhibit the same primary characteristics as the specimens from New Zealand and *C. gyrosa* is regarded as conspecific with one of the species in the New Zealand collections. A new genus, *Amphilogia*, is described for the collections of *C. gyrosa* from Sri Lanka and New Zealand, which also contains the second species from New Zealand, *Amphilogia major* sp. nov.

KEYWORDS: *Amphilogia gyrosa*, *Amphilogia major*, *Cryphonectria*, Diaporthales, *Elaeocarpus*, *Endothia*, New Zealand.

INTRODUCTION

The fungal genus *Cryphonectria* (Sacc.) Sacc., as outlined by Barr (1978), includes *Cryphonectria parasitica* (Murrill) M. E. Barr, which is one of the world's most important plant pathogens. This fungus causes the devastating disease known as chestnut blight that completely changed the composition of hardwood forests in the eastern part of Northern America during the first half of the 20th Century (Brewer, 1995), and also caused extensive damage in Europe (Anagnostakis, 1987; Heiniger & Rigling, 1994). Most other species of *Cryphonectria* are either known to be saprobic or their pathogenicity has not been tested. *Cryphonectria radicalis* (Schwein.: Fr.) M. E. Barr occurs in North America, Europe (Shear & al., 1917; Roane, 1986) and Japan (Kobayashi, 1970) primarily on Fagaceae (Fagales). *Cryphonectria macrospora* (T. Kobay. & Kaz. Itô) M. E. Barr and *Cryphonectria nitschkei* (G. H. Otth) M. E. Barr occur mainly on Fagaceae in Japan (Kobayashi, 1970; Roane, 1986).

Cryphonectria havanensis (Bruner) M. E. Barr was first described from *Eucalyptus* spp. in Cuba (Bruner, 1916). Reports of this fungus from Japan on Fagaceae (Kobayashi, 1970; Roane, 1986) represent *C. nitschkei*, although it is unclear whether the fungus in Japan and Cuba are the same (Myburg & al., 2004a). *Cryphonectria coccolobae* (Vizioli) Micales & Stipes occurs on stems of seagrape (*Coccoloba uvifera* (L.) L. - Polygonaceae, Polygonales) in the Caribbean (Vizioli, 1923).

Other species that have been known in *Cryphonectria* have recently been transferred to new genera. *Cryphonectria longirostris* (Earle) Micales & Stipes is now classified in *Rostraureum* Gryzenhout & M. J. Wingfield (Gryzenhout & al., 2005b). *Chrysosporthe* Gryzenhout & M. J. Wingf. has been described to accommodate *Cryphonectria cubensis* (Bruner) Hodges (Gryzenhout & al., 2004). *Cryphonectria eucalypti* M. Venter & M. J. Wingf. is suspected to be distinct from *Cryphonectria sensu stricto* (Myburg & al., 2004b) although this question has not been fully resolved.

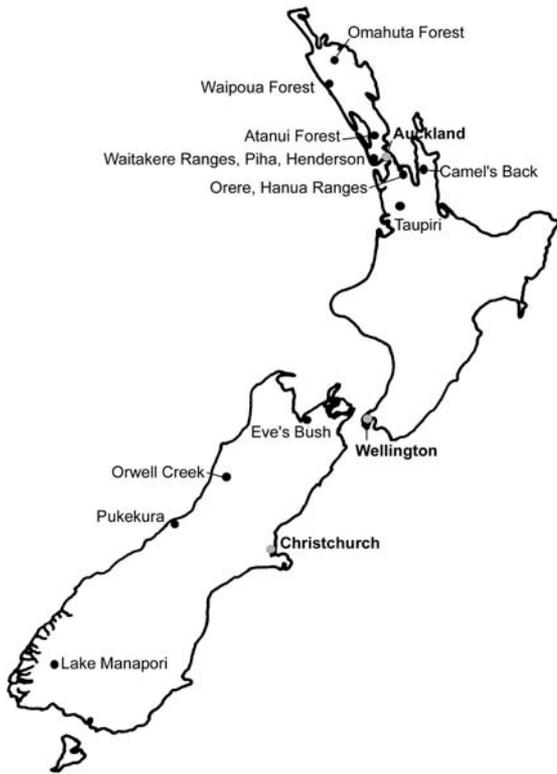


Fig. 1. Map of New Zealand showing the locations of herbarium specimens from *Elaeocarpus* spp.

Endothia Fr. is a genus that resembles *Cryphonectria* morphologically and the taxonomy of these two genera has been confused. Both *Endothia* and *Cryphonectria* have orange, well-developed stromata and similar anamorphs (Shear & al., 1917; Kobayashi, 1970; Roane, 1986), but *Endothia* has aseptate ascospores and large superficial stromata, while *Cryphonectria* has one-septate ascospores and semi-immersed stromata (Barr, 1978; Micales & Stipes, 1987; Venter & al., 2002; Myburg & al., 2004b). *Cryphonectria*, established in 1905 (Saccardo & Saccardo, 1905), was treated as a synonym of *Endothia* from 1909 onwards (Von Höhnel, 1909; Shear & al., 1917; Kobayashi, 1970). In 1978, Barr suggested that the two genera should be treated as distinct (Barr, 1978; Micales & Stipes, 1987). Recent phylogenetic studies, based on DNA sequence data, have supported this separation, but they have also shown that these two genera are closely related (Zhang & Blackwell, 2001; Castlebury & al., 2002; Venter & al., 2002; Myburg & al., 2004a, b).

Cryphonectria was first described as a subgenus of *Nectria* (Fr.) Fr. (Saccardo, 1883), with two species, *Nectria variicolor* Fuckel and *Nectria abscondita* Sacc., listed. *Cryphonectria gyrosa* (Berk. & Broome) Sacc. was listed as *Nectria gyrosa* Berk. & Broome under another subgenus, *Nectria* “subg. *Eunectria* Sacc.”

(Saccardo, 1883). When *Cryphonectria* was elevated to genus level (Saccardo & Saccardo, 1905), *Cryphonectria abscondita* Sacc., *Cryphonectria variicolor* (Fuckel) Sacc., *Cryphonectria gyrosa* and three other species, namely *Cryphonectria moriformis* (Starbäck) Sacc., *Cryphonectria caraganae* (Höhn.) Sacc. and *Cryphonectria xanthostroma* (Penz. & Sacc.) Sacc. were included. No type was designated, and the species were listed numerically with *C. gyrosa* placed first in the list (Saccardo & Saccardo, 1905). Von Höhnel (1909) reduced *C. gyrosa* (Berk. & Broome) Sacc. to synonymy with *Endothia gyrosa* (Schwein.: Fr.) Fr., the type of *Endothia* (Fries, 1849). He also chose *C. gyrosa* as type of *Cryphonectria* because it was listed first, thereby reducing *Cryphonectria* to synonymy with *Endothia*.

The lectotypification of *Cryphonectria* by Von Höhnel (1909) was “based on a largely mechanical method of selection” (Art. 10.5 & *Ex. 7 of the ICBN, Greuter & al., 2000), and hence supersedeable. Furthermore, it is unacceptable because *C. gyrosa* was not one of the original species of *Nectria* subg. *Cryphonectria* upon which the generic name was based. Von Höhnel’s incorrect typification was, however, accepted by Barr (1978), but his synonymy of *C. gyrosa* with *E. gyrosa* was rejected based on differences in ascospore and stromatal morphology between these two genera. It is possible that Von Höhnel based his synonymy, which confirmed observations by Petch (1907), on comparisons of *C. gyrosa* with European *C. radicalis* specimens, a species which was at that time regarded as synonymous with *E. gyrosa*, as summarised by Shear & al. (1917). *Cryphonectria gyrosa* has been erroneously cited as type of the generic name *Cryphonectria*. Since the only valid candidates for type, namely *C. abscondita* and *C. variicolor*, were either unidentifiable or not diaporthean, conservation of the generic name *Cryphonectria* with *C. parasitica* as type has been proposed (Gryzenhout & al., 2005a).

Cryphonectria gyrosa was first described from Sri Lanka (Berkeley & Broome, 1875; Shear & al., 1917) and is associated with *Elaeocarpus* spp. Two specimens are connected to the first description of *C. gyrosa* (Berkeley & Broome, 1875), but both with hosts unknown. The type specimen (K 109807, originally #638) is from a twig from an unknown locality in Sri Lanka. The second specimen (K 109809, originally #290) was collected at 6000 feet (1850 m) in Nuwara (Mount) Eliya, Sri Lanka. A third collection of specimens (BPI 614797, BPI 614526), believed to represent the same fungus as those connected to the earlier description of *C. gyrosa*, was obtained by Shear & al. (1917) when they redescribed this fungus as a new species, *Endothia tropicalis* Shear & N. E. Stevens. The latter species was described to rectify what the authors

believed was an erroneous synonymy with *E. gyrosa* (Shear & al., 1917) introduced by Von Höhnel (1909). These specimens (BPI 614526, BPI 614797, both as number 2807) were collected from Hakgala, Sri Lanka, on *Elaeocarpus glandulifer* Mast. and were used as the type specimens for *E. tropicalis* (Shear & al., 1917). A report of *C. gyrosa* on *Elaeagnus* (Barr, 1978) actually represents *Elaeocarpus* (Myburg & al. 2004b). Specimen K 109809 was mentioned by Shear & al. (1917) in their description of *E. tropicalis*, but the type specimen, K 109807, of *C. gyrosa* was not considered. There are no cultures linked to the original description of *C. gyrosa* or any more recent collections of the fungus from Sri Lanka.

A recent phylogenetic study including all available isolates of *Endothia* and *Cryphonectria* spp. (Myburg & al., 2004b), has shown that, besides the strongly resolved clades representing *Endothia* and *Cryphonectria*, additional and distinct groups exist. One of these represents species of the newly described genus *Chrysoportha*, which includes the *Eucalyptus* canker pathogen previously known as *C. cubensis* (Gryzenhout & al., 2004). Isolates from *Elaeocarpus* spp. (Elaeocarpaceae, Oxalidales) in New Zealand that were labeled as *C. radicalis* and *C. gyrosa* (= *Endothia tropicalis*), respectively, formed the other group.

The aim of this study was to provide a name for specimens linked to isolates from New Zealand, which have been shown to be distinct from *Cryphonectria* based on DNA sequence comparisons (Myburg & al., 2004b). The isolates from New Zealand identified as *C. gyrosa* were collected from cankers on the roots of *Elaeocarpus hookerianus* Raoul and *Elaeocarpus dentatus* Vahl (Gilmour, 1966; Dingley, 1969; Pennycook, 1989) that occur on both the North and South Islands of New Zealand (Fig. 1). We have also considered whether specimens labeled as *C. gyrosa* from New Zealand represent the same fungus as that known as *C. gyrosa* from Sri Lanka.

MATERIALS AND METHODS

Morphological comparisons. — Herbarium specimens, including fruiting structures linked to isolates from *Elaeocarpus* spp. in New Zealand and recognized by Myburg & al. (2004b) as representing a discrete species, were obtained from various herbaria (Appendix). These specimens had been collected from a number of locations in New Zealand (Fig. 1). Cultures are not available for most of these collections. Specimens from Sri Lanka representing *C. gyrosa*, as well as other species of *Cryphonectria* and *Endothia*, were also included (Appendix).

Fruiting structures and surrounding bark were removed from the specimens. These were rehydrated in boiling water for 1 min, mounted in Leica mountant (Setpoint Premier, Johannesburg, South Africa) and sectioned at 12–18 μm thickness, with a Leica CM1100 cryostat (Setpoint Premier) at -20°C . The mountant was removed in water and the sections were transferred to lactophenol. Sections of perithecial bases and conidial locules were also made by hand and mounted in lactophenol or 3% KOH for further study. Twenty measurements were taken of conidia, conidiophores, asci and ascospores from each specimen, but fifty measurements were taken from the holotype specimens. Measurements were made using an HRc AxioCam digital camera and Axiovision 3.1 software (Carl Zeiss Ltd., Germany).

Colony growth of isolates CMW 10469 and CMW 10471 (Appendix), identified as *C. radicalis* and *C. gyrosa* respectively, but residing in the unique phylogenetic clade characterised by Myburg & al. (2004b), was studied on MEA (20 g/l malt extract, 15 g/l agar [Biolab, Merck, South Africa]). CMW is the culture collection of the Forestry & Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa, 0002. Growth was observed in the dark at five temperatures ranging from 15 to 35°C at 5°C intervals. A disc 6 mm diam., taken from actively growing cultures, was placed at the center of four 90 mm plates for each isolate and at each temperature. Two diameter measurements (mm), perpendicular to each other, were taken for each plate daily and the means of the eight measurements for each isolate were compared. The experiment was terminated after six days, when the colonies completely covered the plates at the optimum temperature for growth.

RESULTS

Morphological comparisons. — Measurement of ascospores on specimens from New Zealand could be used to recognize two distinct species in this study. Herbarium specimens (NY 31874, PDD 32619) from which isolates CMW 10469, CMW 10470 and CMW 10471 originated and that formed the phylogenetic group described by Myburg & al. (2004b), have ascospores (9–)9.5–11.5(–12) μm long. The majority of specimens from *Elaeocarpus* spp. in New Zealand (Table 1) have ascospores falling within this range [(7–)8.5–11(–13.5) μm long]. Specimens PDD 20056 and PDD 28490, however, have distinctly longer ascospores [(10.5–)11.5–14(–15.5) μm]. Ascospores have one or two septa (Fig. 2E, 3C) except PDD 20056 and PDD 28490 with one to three septa (Fig. 4E, 5C). There are no isolates connected to the specimens with larger ascospores and their phylogenetic position cannot be resolved, although

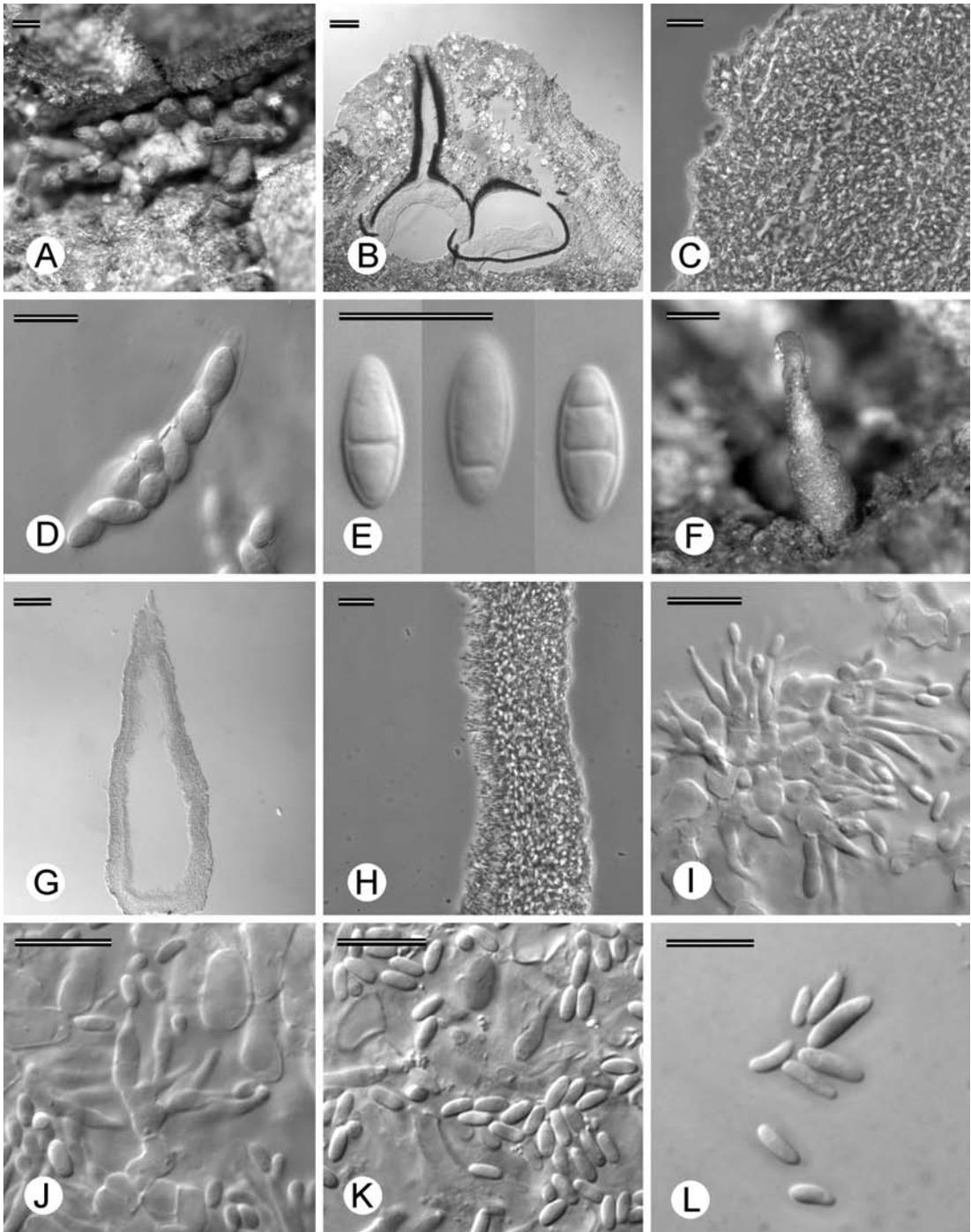


Fig. 2. Micrographs of specimens of *Amphilogia gyrosa* from New Zealand linked to the phylogenetic clade characterized by Myburg & al. (2004b). A, ascostroma on bark with long perithecial necks; B, vertical section through ascostroma; C, stromatic tissue of ascostroma; D, ascus; E, ascospores with different septation; F, conidioma on bark; G, vertical section through conidioma; H, stromatic tissue of conidioma, longitudinally sectioned; I, J, conidiophores and conidiogenous cells; K, L, conidia. Bars: A, F = 200 μ m; B, G = 100 μ m; C, H = 20 μ m; D, E, I–L = 10 μ m.

they are morphologically similar to those for which isolates are available in other respects than ascospore morphology.

Myburg & al. (2004b) previously found that speci-

mens from *E. dentatus* and *E. hookerianus* in New Zealand differ from *Cryphonectria* and *Endothia* spp. Ascospores of the New Zealand specimens have one to three septa in irregular positions (Fig. 2E, 3C, 4E, 5C).

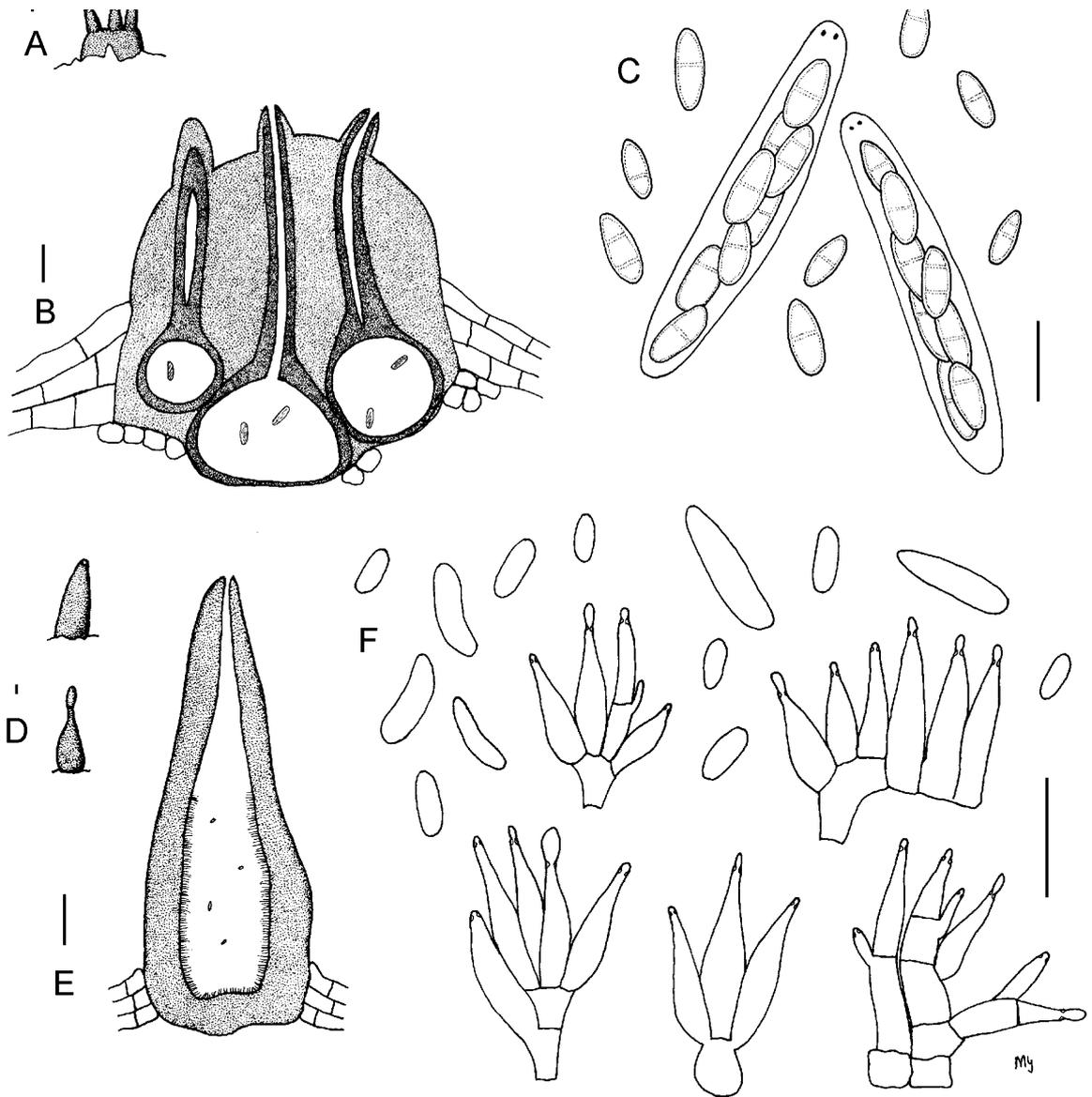


Fig. 3. Line drawings of *Amphilogia gyrosa*. A, shape of ascostroma on bark; B, vertical section through ascostroma; C, asci and ascospores; D, shapes of conidiomata on bark; E, vertical section through conidioma; F, conidiophores, conidiogenous cells and conidia. Bars: A, B, D, E = 100 μ m; C, F = 10 μ m.

These are different from ascospores of *Cryphonectria* species that typically have one median septum (Kobayashi, 1970; Roane, 1986; Myburg & al., 2004b). Conidia are often variable in size (Fig. 2K–L, 3F, 4K–L, 5F), ranging from 3–12 μ m in length, whereas conidia of *Cryphonectria* are generally more uniform in size, ranging from 2–5 μ m (Kobayashi, 1970; Roane, 1986). Conidiomata of the New Zealand specimens are typically superficial, conical to fluted (Fig. 2F, 3D, 4F, 5D), although conidial locules can also be observed inside stromata that contain perithecial necks. This is different from *Cryphonectria* species, which have semi-immersed, pulvinate conidiomata (Kobayashi, 1970; Venter & al.,

2002; Myburg & al., 2004b). Furthermore, ascostromata on the New Zealand specimens are pulvinate and erumpent with perithecia formed in a diatrypoid orientation (Fig. 2B, 3B, 4B, 5B). This is more similar to stromata of *Endothia*, but *Endothia* spp. have aseptate, cylindrical ascospores (Shear & al., 1917; Kobayashi, 1970; Venter & al., 2002; Myburg & al., 2004b) that can easily be distinguished from those of the structures on *Elaeocarpus* spp.

Careful study of the specimens (K 109807, K 109809) linked to the original description of *C. gyrosa* from Sri Lanka, revealed that the structures originally described for *C. gyrosa* are identical to those on the spec-

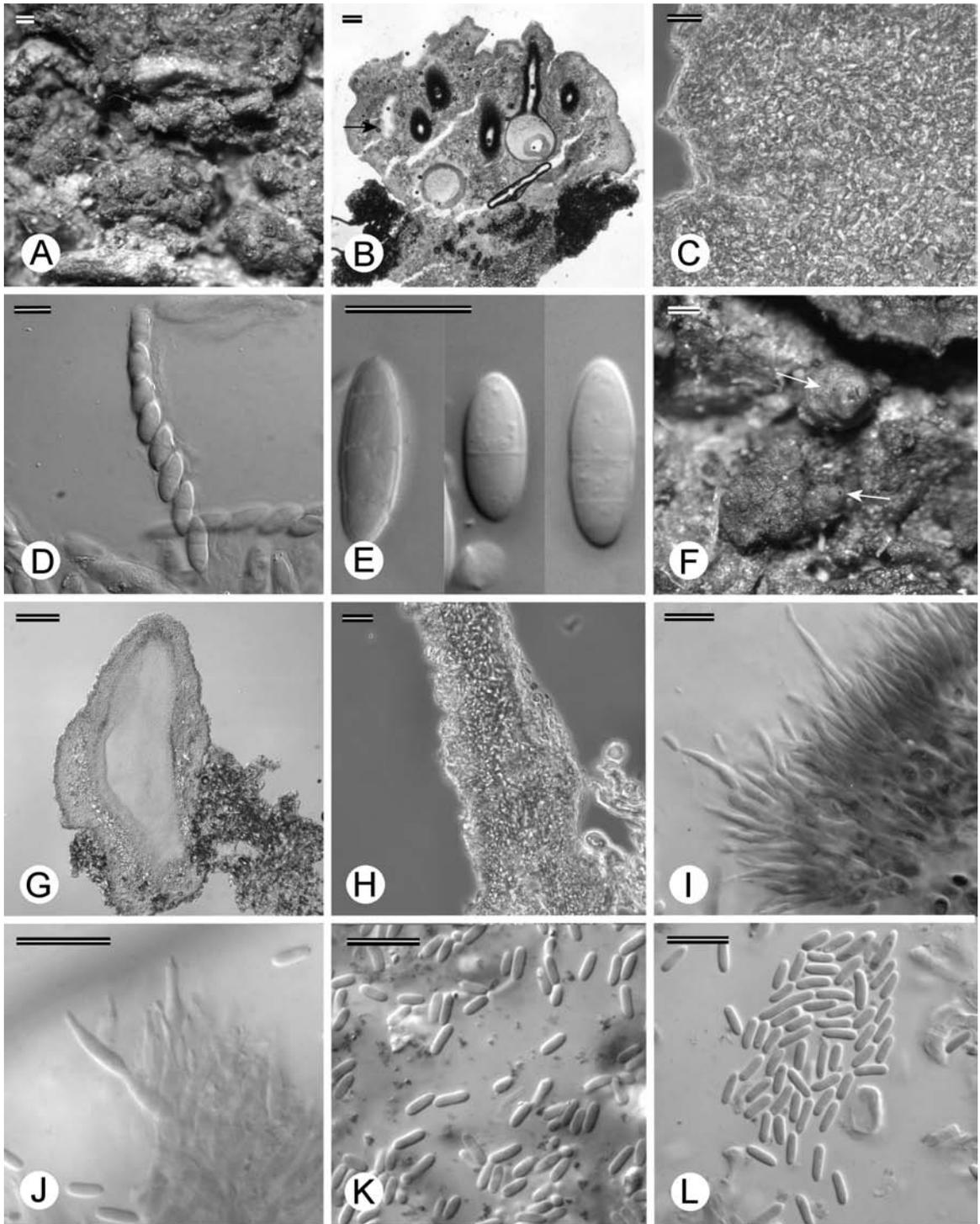


Fig. 4. Micrographs of specimens of *Amphilogia major* from New Zealand. A, ascostromata on bark with perithecial necks; B, vertical section through ascostroma, with conidial locule indicated with arrow; C, stromatic tissue of ascostroma; D, ascus; E, ascospores with different septation; F, conidiomata on bark (arrows); G, vertical section through conidioma; H, stromatic tissue of conidioma, longitudinally sectioned; I–J, conidiophores and conidiogenous cells; K, L, conidia. Bars: A, B, F, = 200 μ m; G = 100 μ m; C, H, = 20 μ m; D, E, I–L = 10 μ m.

imens linked to the description of *E. tropicalis* (BPI 614797, BPI 614256, BPI 797701). The type specimen

of *C. gyrosa* (K 109807), however, contains few recognizable structures, and only a few of these structures

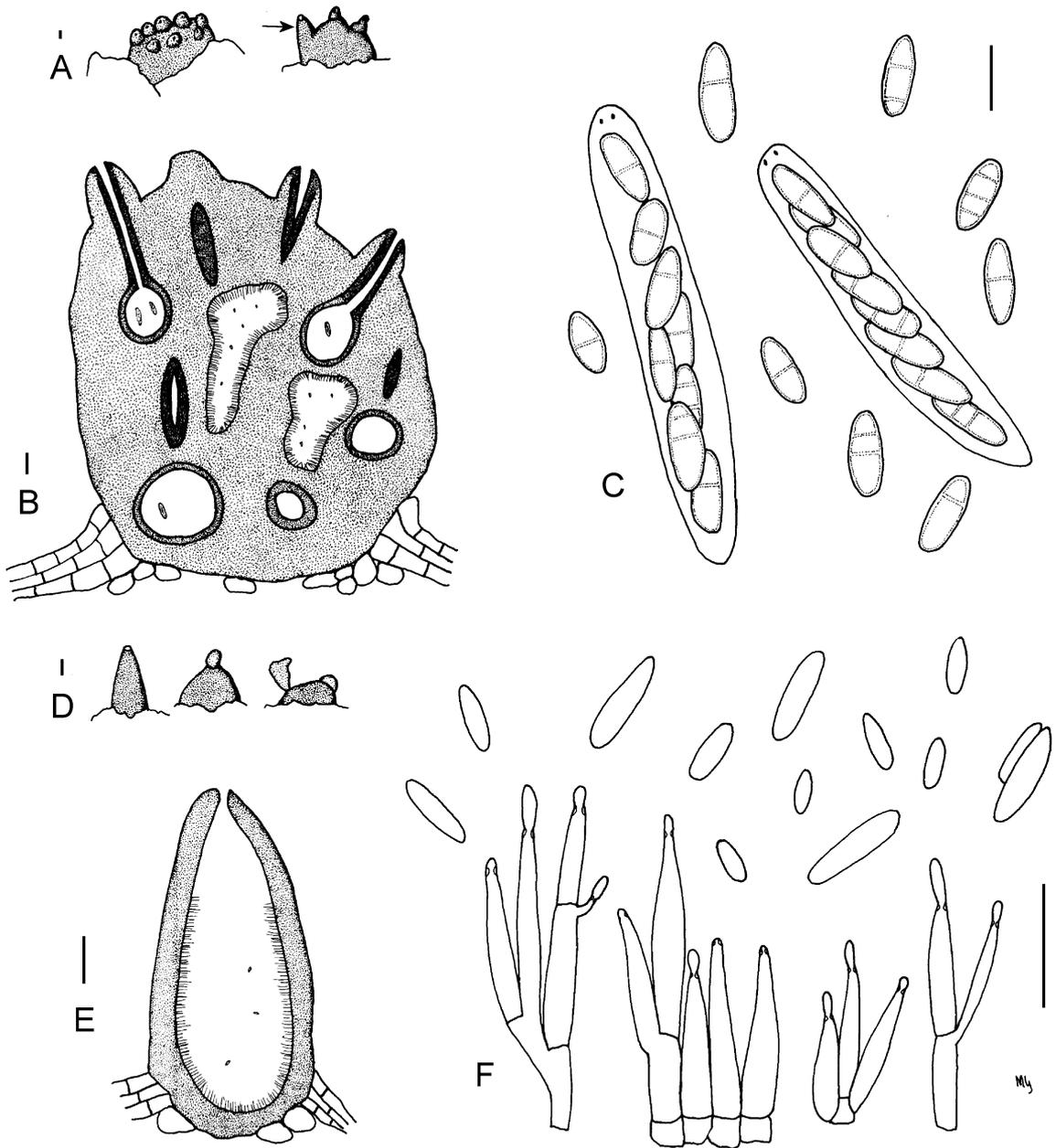


Fig. 5. Line drawings of *Amphilogia major*. A, shapes of ascostromata on bark with conidioma indicated with arrow; B, vertical section through ascostroma; C, asci and ascospores; D, shapes of conidiomata on bark; E, vertical section through conidioma; F, conidiophores, conidiogenous cells and conidia. Bars: A = 200 μm ; B, D, E = 100 μm ; C–F = 10 μm .

could be used. Structures on the *C. gyrosa* specimens from Sri Lanka also had a morphology identical to specimens from *Elaeocarpus* spp. in New Zealand, which have previously been assigned the name *C. gyrosa*. Ascospores of the Sri Lankan fungus were generally one-septate, but ascospores with two irregularly spaced septa were found in all three specimens (Fig. 6E, F). Ascospores of the *C. gyrosa* specimens from Sri Lanka [(7–)8–9.5(–11.5) μm long] overlapped in size with those of the group from

New Zealand with smaller ascospores [(7–)8.5–11(–13.5) μm long]. Specimens BPI 614797 [(4–7(–10) μm long] and K 109809 [4.5–10(–14) μm long], also had conidia (Fig. 6L) that fell within the size range [(3–)4–8.5(–12) μm long] of the specimens for both groups of fungi from New Zealand. Ascostromata on specimens BPI 614797 and K 109807 representing the Sri Lankan fungus (Fig. 6A, B), were identical to those of structures on New Zealand specimens, and specimen BPI 614797 contained

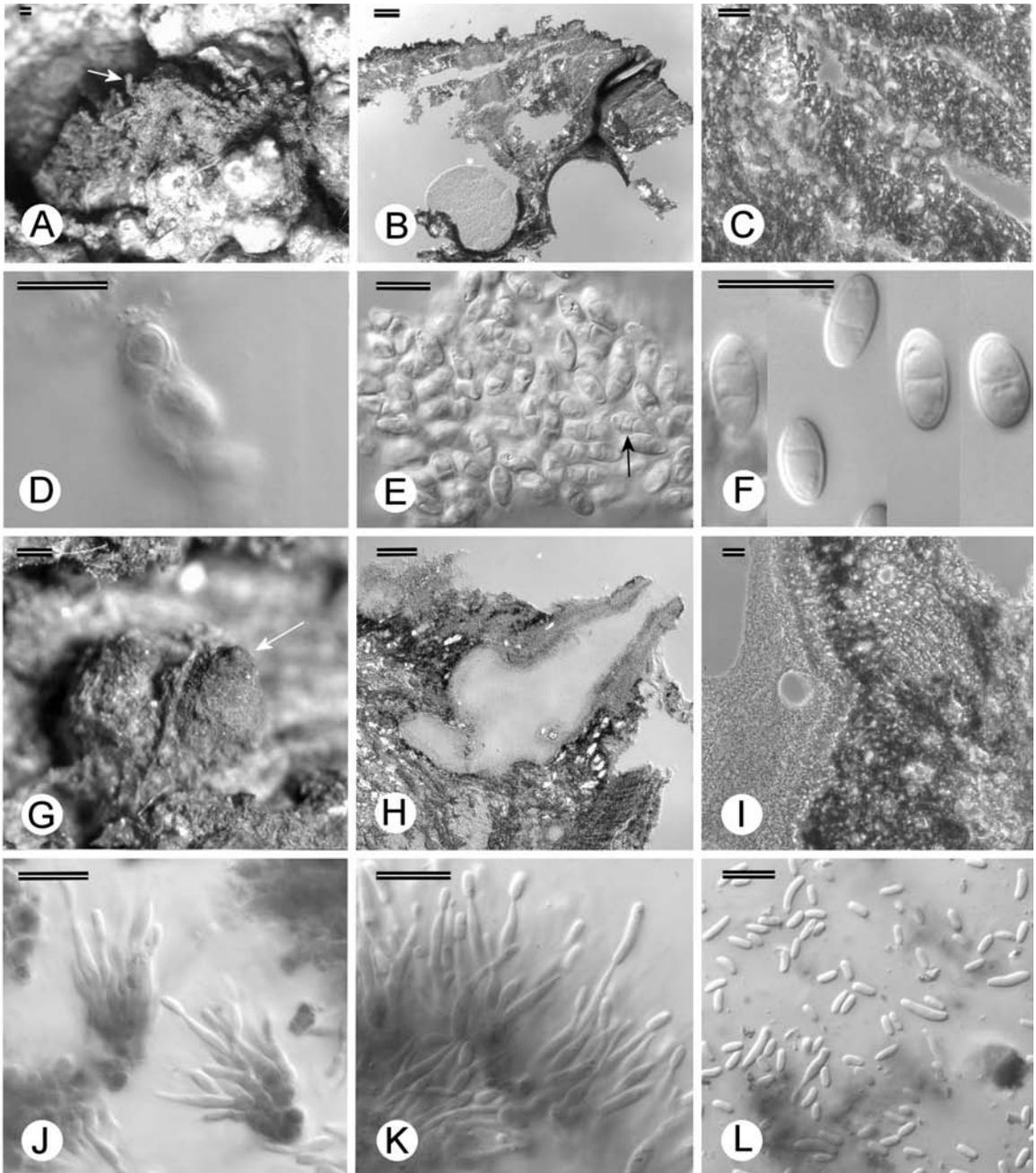


Fig. 6. Micrographs of Sri Lankan specimens of *Amphilogia gyrosa*. A, ascostroma on bark with long perithecial necks (arrow); B, vertical section through ascostroma; C, stromatal tissue of ascostroma; D, tip of ascus; E, F, ascospores with different septation; G, conidioma on bark (arrow); H, vertical section through conidioma; I, stromatic tissue of conidioma, longitudinally sectioned; J, K, conidiophores and conidiogenous cells; L, conidia. Bars A, B, G, = 200 μ m; H = 100 μ m; C–I = 20 μ m; D–F, J–L = 10 μ m.

conical conidiomata (Fig. 6G, H) similar to those found on New Zealand specimens. Specimens representing the Sri Lankan fungus could thus not be distinguished from those originating in New Zealand, connected to isolates that represent a phylogenetic group separate from *Cryphonectria* (Myburg & al., 2004b) and with ascospores (7–)8.5–11(–13.5) μ m long.

DISCUSSION

Results of this study and Myburg & al. (2004b) show that specimens from *Elaeocarpus* spp. in New Zealand, which were previously considered to be *Cryphonectria* spp., are morphologically distinct from other species now classified in *Cryphonectria*. These specimens are

connected to isolates that Myburg & al. (2004b) showed to be phylogenetically distinct from other *Cryphonectria* spp. Furthermore, our examination of a large collection of specimens from New Zealand indicates that the specimens from New Zealand represent two morphologically related but distinct species. Cultures are available for only one of the species and the phylogenetic relatedness of the two species cannot be considered at this time. However, based on morphology, they can justifiably be treated in the same genus.

The most obvious characteristics defining the two fungi from *Elaeocarpus* in New Zealand as distinct from *Cryphonectria* are ascospores that have up to three septa. This was previously noted for specimen PDD 20056 by Roane (1986). Conidiomata are also different from those found in species of *Cryphonectria* (Shear & al., 1917; Micales & Stipes, 1987; Myburg & al., 2004b). These are typically superficial on the host tissue and are conical to fluted. In contrast, other species of *Cryphonectria* have ascospores with one septum, and conidiomata that are semi-immersed and pulvinate (Myburg & al., 2004b).

Specimens of *C. gyrosa* from Sri Lanka, including the type specimen and the type specimen of *E. tropicalis* previously treated as a synonym of *C. gyrosa*, were indistinguishable from the New Zealand collections from *Elaeocarpus*. They have ascospores of the same size and with one to two septa, although this form of septation has not previously been noted for *C. gyrosa* (Berkeley & Broome, 1875; Saccardo & Saccardo, 1905; Shear & al., 1917; Barr, 1978; Roane, 1986; Micales & Stipes, 1987). Furthermore, conidia are variable in size and fall within the same range as those of specimens from New Zealand. Conidiomata also have a conical to pyriform shape, similar to the New Zealand fungus and different from the pulvinate structures of *Cryphonectria* spp. (Myburg & al., 2004b). We conclude that *C. gyrosa sensu stricto* most likely will group in the distinct phylogenetic clade representing the New Zealand specimens as defined by Myburg & al. (2004b).

A proposal to conserve the generic name *Cryphonectria* with a conserved type (Gryzenhout & al., 2005a), showed that the extensive citation of *C. gyrosa* as type of *Cryphonectria* is contrary to Art. 7.4 of the ICBN (Greuter & al., 2000). Since *C. gyrosa* is not eligible as type, it will have no effect on the name *Cryphonectria* if *C. gyrosa* is transferred to another genus. The fungus known as *C. gyrosa* from Sri Lanka and the specimens from *Elaeocarpus* spp. in New Zealand are thus described in a new genus that is closely related to *Cryphonectria*. *Cryphonectria gyrosa* and the specimens with smaller ascospores from New Zealand are treated as one species, the name of which is designated as the type of the new generic name. A second species from *Elaeocarpus* in New Zealand with larger ascospores, is also recognized. A

name is provided for this fungus even though cultures and thus DNA sequence data are not available for it. Description of the new genus for the fungus previously known as *C. gyrosa* and the second new species, are provided below. A key facilitating the identification of the new genus and the species residing in it is also provided.

***Amphilogia* Gryzenhout, Glen & M. J. Wingf., gen. nov.**

– Typus: *Amphilogia gyrosa*.

Ascstromata aurantiaca, erumpentia, subimmersa vel superficialia, textura stromatica bene evoluta, pulvinata, collis perithecorum papillatis vel longis. *Asci* octospori, fusoidi. *Ascosporae* hyalinae, fusoidae vel ellipsoideae, uno vel tribus septis irregulariter dispositis divisae.

Conidiomata aurantiaca, discreta vel super ascostromata, interdum etiam velut loculi in ascostromate videntur, superficialia, conica vel pyriformia vel striata, unilocularia. *Conidiophora* hyalina cum *cellulis conidiogenis* phialidicis apicalibus vel lateralibus in ramis sub septo oriundis. *Conidia* hyalina, aseptata, oblonga vel subfalcata, magnitudine variabili.

Ascstromata orange, erumpent, slightly immersed to superficial, stromatic tissue well-developed, pulvinate with papillate to long orange perithecial necks, perithecia diatrypid. *Asci* 8-spored, fusoid. *Ascospores* hyaline, fusoid to ellipsoid, containing one to three irregularly spaced septa.

Conidiomata orange, separate or on top of the ascostromata, also evident occasionally as locules inside ascostroma, superficial, conical to pyriform to fluted, unilocular. *Conidiophores* hyaline with phialidic, irregular branching, determinate *conidiogenous cells* that occur apically or laterally on branches beneath a septum. *Conidia* hyaline, non-septate, oblong to slightly curved, of variable size.

Etymology. — Greek, *amphi*, on both sides, and *logos*, discussion, thus the Greek personification of disputes; referring to the dispute this genus caused regarding the identity of *Cryphonectria*.

***Amphilogia gyrosa* (Berk. & Broome) Gryzenhout, Glen & M. J. Wingf., comb. nov.** Fig. 2, 3, 6. ≡ *Diatrype gyrosa* Berk. & Broome, J. Linn. Soc. London 14: 124. 1875. ≡ *Nectria gyrosa* Berk. & Broome, J. Linn. Soc. London 15: 86. 1877. ≡ *Cryphonectria gyrosa* (Berk. & Broome) Sacc., Syll. Fung. 17: 784. 1905. ≡ *Endothia gyrosa* (Berk. & Broome) Höhn., Sitzb. Kais. Akad. Wiss. Wien, Math. Naturw. Kl. 118: 1480. 1909, nom. illegit. Art. 53, non (Schwein. : Fr.) Fr. Holotype: Sri Lanka. 1868 (K 109807!). Epitype: New Zealand. Auckland: Waitakere Ranges, Spragg's Bush, exposed roots on dead tree, 1973, R. E. Beaver (NY 31874!), living cultures

CMW 10469, CMW 10470 - designated here).

- = *E. tropicalis* Shear & N. E. Stevens, U.S. Dept. Agric. Bull. 380: 20–21. 1917.
 Holotype: Sri Lanka. Hakgala, *Elaeocarpus glandulifer*, 1913, *T. Petch* (BPI 614797!, BPI 614526!).
- = *E. havanensis* Bruner, Bull. Govt. For. Exp. Station 226: 140. 1970. Holotype: Cuba. Santiago de las Vegas, *Eucalyptus* sp., 1916, *S. C. Bruner* (BPI 614275!).

Ascostromata gregarious on bark, often occurring in cracks, often confluent, pulvinate, erumpent, slightly immersed to superficial (Fig. 2A, B, 3A, B, 6A, B), 460–500 µm high, 660–950 µm diam., orange, well-developed stromatic tissue (Fig. 2C, 6C), prosenchyma at the center, pseudoparenchyma at the edges, orange. Perithecia surrounded with fungal tissue or with bases touching the host tissue, diatrypoid, globose to sub-globose (Fig. 2B, 3B, 6B), 340–400 µm diam., walls black, 17–21 µm thick, up to 22 perithecia in a stroma. Perithecial necks periphysate, black, slender (Fig. 2B, 3B, 6B), 80–120 µm wide, breaking through the stromatal surface as papillae or long cylindrical beaks covered with orange tissue (Fig. 2A, B, 3A, B, 6A), protruding necks up to 440 µm long, 100–200 µm wide. Asci (43–)46–52(–55) × (6–)7–8(–9) µm, fusoid, floating freely in the perithecial cavity, stipitate only when immature, unitunicate with non-amyloid, refractive apical ring, 8-spored, biseriata (Fig. 2D, 3C). *Ascospores* (9–)9.5–11.5(–12) × (3.5–)4–5(–5.5) µm, oval, hyaline, containing one or two irregularly spaced septa (Fig. 2E, 3C, 6E, F).

Conidiomata separate (Fig. 2F, 3D, 6G) or above the ascostromata, also appearing as locules inside ascostromata, individual conidiomata unilocular (Fig. 2G, 3E, 6H), 400–890 µm high, 100–370 µm diam., orange, superficial, conical to pyriform to fluted, conidiomatal tissue pseudoparenchymatous (Fig. 2H). *Conidiophores* (10.5–)13–19(–24) µm long, branched irregularly, cells delimited by septa or not, hyaline (Fig. 2I, J, 3F, 6J, K). *Conidiogenous cells* phialidic, determinate, branches arising beneath a septum, cylindrical to flask-shaped with attenuated apices, (1–)1.5–2.5(–3) µm wide, collarete and periclinal thickening inconspicuous (Fig. 2I, J, 3F, 6J, K). *Conidia* (3–)4–8.5(–12) × (1.5–)2–2.5(–3.5) µm, non-septate, oblong to slightly curved, hyaline (Fig. 2K, L, 3F, 6L).

Cultures (CMW 10469, CMW 10471) on MEA white when young, often with a luteous center, becoming orange when older, flat and striate with a smooth to sinuous margin, fast growing, covering a 90 mm plate after a minimum of six days; optimum temperature 25–30 °C.

Etymology. — Greek, *gyrus*, circle, thus round.

Host. — Roots of *Elaeocarpus dentatus*, *E. hookerianus* and *E. glandulifer*.

Distribution. — New Zealand, Sri Lanka.

Additional material examined. — Sri Lanka.

Nuwara (Mount) Eliya, *Elaeocarpus glandulifer*, *G. H. K. Thwaites* (K 109809). Hakgala, *Elaeocarpus glandulifer*, 1913, *T. Petch* (BPI 614797!, BPI 614526!). New Zealand. Auckland: Atanui State Forest, *E. dentatus*, 1973, *G. J. Samuels* (PDD 32619, living culture CMW 10471). Waitakere Ranges, *E. dentatus*, 1958, *J. M. Dingley* (PDD 18377). Titirangi, unidentified living tree, 1973, *J. M. Dingley* & *G. J. Samuels* (NY 30873). Waitakere Ranges, Fairy Falls track, *E. dentatus*, 1963, *J. M. Dingley* (PDD 21944). Waitakere Ranges, Waitatarua, *E. dentatus*, 1963, *J. M. Dingley* (PDD 25570). Waitakere Ranges, Cutty Grass track, *E. dentatus* root, 1959, *S. McBeth* (PDD 28497). Waitakere Dam, *E. dentatus*, 1966, *J. M. Dingley* (PDD 25003). Waitakere Ranges, Upper Piha Valley, *E. dentatus* fallen trunk, 1949, *J. M. Dingley* (PDD 28485). Upper Piha, *E. dentatus*, 1947, *J. M. Dingley* (PDD 28482). Waitakere Ranges, Piha, *E. dentatus*, 1948, *J. M. Dingley* (PDD 28484). Orere, *E. dentatus*, 1963, *S. J. Hughes* (PDD 20570). Orere, *E. dentatus*, 1953, *J. M. Dingley* (PDD 28487). Hanua Ranges, *E. dentatus*, 1953, *J. M. Dingley* (PDD 28488). Hanua Ranges, Moumoukai Valley, *E. dentatus*, 1932, *L. M. Cranwell* (PDD 3841). Henderson, off Stony Creek, *E. dentatus* root, 1948, *J. M. Dingley* (PDD 28483). Henderson, Walker's Bush, *E. dentatus*, 1958, *S. McBeth* (PDD 28494). Henderson Valley, Sharps Bush, *E. dentatus*, 1972, *J. M. Dingley* (PDD 29819). Northland: Omahuta State Forest, *E. dentatus*, 1963, *S. J. Hughes* (PDD 21242). Waipoua, *E. dentatus*, 1955, *J. M. Dingley* (PDD 28492). Coromandel: Camel's Back, *E. dentatus* exposed root, 1934, *J. M. Dingley* (PDD 28489). Waikato: Taupiri Mt., *E. dentatus*, 1954, *J. M. Dingley* (PDD 28491). Buller: Orwell Creek, Granville Forest, *E. hookerianus*, 1963, *J. M. Dingley* (PDD 23365).

Amphilogia major Gryzenhout, Glen & M. J. Wingf., **sp. nov.** Figs. 4, 5. — Holotype: New Zealand. Fiordland: Lake Manapouri, *Elaeocarpus hookerianus*, 1948, *J. M. Dingley* (PDD 20056!).

Ascostromata pulvinata vel tuberculata, erumpentia, partim immersa in pulvino stromatico bene evoluto aurantiaco. Perithecia textura stromatica circumdata vel basi hospitem tangentia, globosa vel subglobosa, parietibus nigris. Colla perithecorum periphysata, nigra, tenuia, per superficiem stromatis ut papillae vel rostra longa cylindrica textura aurantiaca tecta erumpentia. *Asci* fusoides, solum immaturi stipitati, unitunicati, annulo apicali non amyloideo, refractivo, octospori, biseriatati vel uniseriatati. *Ascospores* ovaes, hyalinae, uno vel tribus septis irregulariter dispositis divisae.

Conidiomata discreta vel ascostromati insidentia,

etiam ut loculi in ascostromate videntur, conidiomata singula unilocularia, aurantiaca, superficialia, conica vel pyriformia. *Conidiophora* irregulariter ramosa, septata an non, hyalina. *Cellulae conidiogenae* phialidicae, cylindricae vel ampulliformes apicibus attenuatis, collari incrassationeque periclinali inconspicuis. *Conidia* non septata, oblonga vel subfalcata, hyalina.

Ascostromata gregarious on bark, often confluent, pulvinate to tuberculate, erumpent, slightly immersed to superficial (Fig. 4A, B, 5A, B), 1600–1750 μm high, 1050–3050 μm diam., orange, well-developed stromatic tissue (Fig. 4C), prosenchyma at the center, pseudoparenchyma at the edges, orange. Perithecia surrounded with fungal tissue or with bases touching the host tissue, diatrypoid, base globose to sub-globose (Fig. 4B, 5B), 330–660 μm diam., walls black, 13–25 μm thick, up to 25 perithecia in a stroma. Perithecial necks periphysate, black, slender (Fig. 4B, 5B), 170–260 μm wide, breaking through the stromatal surface as papillae or long cylindrical beaks which are covered with orange tissue (Fig. 4A, B, 5A); protruding necks up to 460 μm long, 140–510 μm wide. *Asci* (47–)57.5–77(–87.5) \times (7.5–)9–11(–12) μm , fusoid, floating freely in the perithecial cavity, stipitate only when immature, unitunicate with non-amyloid, refractice apical ring, 8-spored, biseriate or uniseriate (Fig. 4D, 5C). *Ascospores* (10.5–)11.5–14(–15.5) \times (4.5–)5–6(–6.5) μm , oval, hyaline, containing one to three irregularly spaced septa (Fig. 4E, 5C).

Conidiomata separate (Fig. 4F, 5D) or on top of ascostromata (Fig. 4F, 5A), also appearing as locules inside ascostromata (Fig. 4B, 5B), individual conidiomata unilocular (Fig. 4G, 5E), 240–820 μm high, 260–500 μm diam., orange, superficial, conical to pyriform, conidiomatal tissue pseudoparenchymatous. *Conidiophores* (4.5–)8.5–19.5(–32.5) μm long, branched irregularly, cells delimited by septa or not, hyaline (Fig. 4I–J, 5F). *Conidiogenous cells* phialidic, determinate, apical or lateral on branches arising beneath a septum, cylindrical to flask-shaped with attenuated apices, (1–)1.5–2.5(–3) μm wide, colarrette and periclinal thickening inconspicuous (Fig. 4I, J, 5F). *Conidia* (3–)3.5–7.5(–12) \times (1–)1.5–2(–2.5) μm , non-septate, oblong to slightly curved, hyaline (Fig. 4K, L, 5F).

No cultures are available for this fungus.

Etymology. — Latin *major*, greater, pointing to the ascospores that are larger than those of *A. gyrosa*.

Host. — Roots of *Elaeocarpus hookerianus* and *E. dentatus*.

Distribution. — New Zealand.

Additional material examined. — New Zealand. Westland: Pukekura, *Elaeocarpus dentatus*, 1954, J. M. Dingley (PDD 28490).

The following key summarises the morphological differences among *Amphilogia*, *Cryphonectria* and *Endothia* and should serve as aid in the identification of unknown specimens:

- 1a. Ascospores aseptate; conidiomata superficial, pulvinate; conidia relatively uniform in size, 3–4 μm long *Endothia*
- 1b. Ascospores septate 2
- 2a. Conidiomata often superficial, conical to fluted; ascospores 1–3-septate; conidia variable in size, 3–12 μm long *Amphilogia*
- 2b. Conidiomata semi-immersed, pulvinate; ascospores always 1-septate; conidia relatively uniform in size, 2–5 μm long *Cryphonectria*

Amphilogia major can be distinguished from *A. gyrosa* based on features of the teleomorph. Conidiomatal structures do not have explicit diagnostic characteristics. Conidiomata of *A. gyrosa* are often more slender than those of *A. major*, but this feature may be influenced by environmental conditions such as humidity. The following key is presented to distinguish between the two species:

- 1a. Asci up to 55 μm long; ascospores (9–)9.5–11.5(–12) μm long *A. gyrosa*
- 1b. Asci longer than 55 μm ; ascospores (10.5–)11.5–14(–15.5) μm long *A. major*

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Appendix. Specimens of *Amphilogia*, *Cryphonectria* and *Endothia* species examined in morphological comparisons.**Taxon, Herbarium and accession number, Previous identifications, Host, Origin, Collector, Date.**

Amphilogia gyrosa, PDD 3841, *Endothia tropicalis*, *Elaeocarpus dentatus*, Moumoukai Valley, Auckland, L. M. Cramwell, 1932; *A. gyrosa*, PDD 18377, *E. tropicalis*, *E. dentatus* root, Waitakere Ra., Auckland, J. M. Dingley, 1958; *A. gyrosa*, PDD 20570, *E. tropicalis*, *E. dentatus*, Orere, Auckland, S. J. Hughes, 1963; *A. gyrosa*, PDD 21242, *E. tropicalis*, *E. dentatus*, Omahuta State Forest, Auckland, S. J. Hughes, 1963; *A. gyrosa*, PDD 21944, *E. tropicalis*, *E. dentatus*, Waitakere Ranges, Fairy Falls Track, Auckland, J. M. Dingley, 1963; *A. gyrosa*, PDD 23365, *E. tropicalis*, *Elaeocarpus hookerianus*, Granville forest, Westland, J. M. Dingley, 1963; *A. gyrosa*, PDD 25003, *E. tropicalis*, *E. dentatus*, Waitakere Dam, Auckland, J. M. Dingley, 1966; *A. gyrosa*, PDD 25570, *E. tropicalis*, *E. dentatus*, Waitakere Ranges, Waiatarua, Auckland, J. M. Dingley, 1963; *A. gyrosa*, PDD 28482, *E. tropicalis*, *E. dentatus*, Waitakere Ranges, Auckland, J. M. Dingley, 1947; *A. gyrosa*, PDD 28483, *E. tropicalis*, *E. dentatus* root, Henderson, Auckland, J. M. Dingley, 1948; *A. gyrosa*, PDD 28484, *E. tropicalis*, *E. dentatus*, Piha, Auckland, J. M. Dingley, 1948; *A. gyrosa*, PDD 28485, *E. tropicalis*, *E. dentatus* fallen trunk, Upper Piha Valley, Auckland, J. M. Dingley, 1949; *A. gyrosa*, PDD 28486, *E. tropicalis*, *E. dentatus*, Waipoua, Auckland, J. M. Dingley, 1949; *A. gyrosa*, PDD 28487, *E. tropicalis*, *E. dentatus*, Hunua Ranges, Auckland, J. M. Dingley, 1953; *A. gyrosa*, PDD 28488, *E. tropicalis*, *E. dentatus*, Hunua Ranges, Auckland, J. M. Dingley, 1953; *A. gyrosa*, PDD 28489, *E. tropicalis*, *E. dentatus* exposed root, Coromondel Peninsula, Auckland, J. M. Dingley, 1954; *A. gyrosa*, PDD 28491, *E. tropicalis*, *E. dentatus*, Taupiri Mt., Auckland, J. M. Dingley, 1954; *A. gyrosa*, PDD 28492, *E. tropicalis*, *E. dentatus*, Waipoua, Auckland, J. M. Dingley, 1955; *A. gyrosa*, PDD 28494, *E. tropicalis*, *E. dentatus*, Henderson, Auckland, S. McBeth, 1958; *A. gyrosa*, PDD 28497, *E. tropicalis*, *E. dentatus* root, Waitakere Ranges, Auckland, S. McBeth, 1959; *A. gyrosa*, PDD 29819, *E. tropicalis*, *E. dentatus*, Henderson Valley, Waitemata County, J. M. Dingley, 1972; *A. gyrosa*, PDD 30873 = NY 30873, *Endothia radicalis*, Exposed roots of unidentified, living tree, Titirangi, Auckland, J. M. Dingley & G. J. Samuels, 1973; *A. gyrosa*, PDD 32619^b, *E. tropicalis*, Exposed *E. dentatus* root, Atuanui State Forest, Auckland, G. J. Samuels, 1973; *A. gyrosa* (epitype - designated in this paper), NY 31874^a, *E. radicalis*, Exposed roots on dead tree, Waitakere Ranges, Spragg's Bush, Auckland, R. E. Beaver, 1973; *A. gyrosa*, BPI 614525, *E. tropicalis*, *E. dentatus*, Omahuta forest, Auckland, S. J. Hughes, 1963; *A. gyrosa*, BPI 614524, *E. tropicalis*, *E. dentatus*, Orere, Auckland, S. J. Hughes, 1963; *A. gyrosa*, DAOM 93506a, *E. tropicalis*, *E. dentatus*, Omahuta forest, Auckland, S. J. Hughes, 1963. *Amphilogia major* (holotype), PDD 20056, *E. tropicalis*, *E. hookerianus*, L. Manapouri, Southland, J. M. Dingley, 1948; *A. major*, PDD 28490, *E. tropicalis*, *E. dentatus*, Pukekura, Westland, J. M. Dingley, 1954. *Cryphonectria gyrosa* (holotype)^b, K 109807, *Nectria gyrosa* (#638), Bark, Sri Lanka, n.a., 1868; *C. gyrosa*^b, K 109809, n.a. (#290), Bark, Nuwara Eliya, Sri Lanka, G. H. K. Thwaites, n.a.; *C. gyrosa*^b, BPI 614797, *E. tropicalis*, *Elaeocarpus glandulifer*, Hakgala, Sri Lanka, T. Petch, 1913; *C. gyrosa*^c, BPI 614526, *E. tropicalis*, *E. glandulifer*, Hakgala, Sri Lanka, T. Petch, 1913; *C. gyrosa*^b, BPI 797701, *E. tropicalis*, *E. glandulifer* (as *Elaeagnus glandulifer*), Hakgala, Sri Lanka, n.a., n.a.. *Cryphonectria macrospora* (holotype), TFM: FPH 1057, *Endothia macrospora*, *Shiia siebordii*, Japan, T. Kobayashi, 1954. *Cryphonectria nitschkei* (holotype), TFM: FPH 1045, *Endothia nitschkei*, *Quercus grosseserrata*, Japan, T. Kobayashi, 1954. *Cryphonectria parasitica* (holotype), NY, *Diaporthe parasitica*, *Castanea dentata*, New York, U.S.A., W. A. Murrill, 1905; *C. parasitica*, CUP 2926, *D. parasitica*, *C. dentata*, New York, USA, W. A. Murrill, 1907; *C. parasitica*, TFM: FPH 629, *Endothia parasitica*, *Castanea crenata*, Koganei, Japan, T. Kobayashi, 1953. *Cryphonectria radicalis*, BPI 797697, *E. radicalis*, *Castanea sativa*, Locarno, Switzerland, n.a., 1862; *C. radicalis*, BPI 613739, *Endothia fluens*, *C. sativa*, Stresa, Italy, C. L. Shear, 1913. *Endothia gyrosa*, PREM 56218, *E. gyrosa*, *Quercus phellos*, Raleigh, U.S.A., L. Grand, 1997.

^a NY 31874 is linked to isolates CMW 10469 and CMW 10470, and PDD 32619 is linked to isolate CMW 10471 (Myburg & al., 2004b).^b These specimens now represent *A. gyrosa*.