Neocordana gen. nov., the causal organism of Cordana leaf spot on banana

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Abstract

Cordana leaf spot of banana is shown to be associated with several species of a new genus described here as Neocordana gen. nov. Furthermore, Neocordana belongs to Pyriculariaceae (Magnaporthales) rather than Cordanaeaceae where the type species of Cordana, C. pauciseptata resides. Neocordana is established to accommodate Cordana musae, C. johnstonii, C. versicolor, and a previously undescribed species, N. musicola, which is morphologically and phylogenetically distinct. Neocordana species are found to be associated with leaves of Musa spp. (Musaceae) and Canna denudata (Cannaceae). Based on these results, Cordanaeaceae is best recognized in a separate order, established here as Cordanales ord. nov.

Key Words: Cordanales, Magnaporthales, Musa, plant pathogenic fungi, Pyriculariaceae, systematics

Introduction

Cordana leaf spot is a common and widespread disease on banana and plantain. Although it is considered as a minor pathogen of banana, it can cause serious defoliation of plantains in Central America during and following periods of wet weather (Jones 1999, Ploetz et al. 2003). Cordana leaf spot is characterised by large, pale brown, oval to fusiform necrotic lesions with pale grey concentric rings, with a dark brown border surrounded by a bright yellow halo, separating lesions from healthy leaf tissue (Jones 1999). Most damage occurs when the pathogen gains entry to leaf tissue weakened because of age, adverse environmental conditions, nutritional deficiencies, wounds or through lesions caused by other pathogens. The leaves ultimately turn brown and dry out (Jones 1999). This is especially apparent when the disease occurs together with Sigatoka leaf spots (Arzanlou et al. 2008), in which case the lesions may encompass the entire leaf margin and large portions of the lamina can be affected (Ploetz et al. 2003). Leaf infection normally occurs at night during rainy periods or when dew is present. The conidia germinate in a film of moisture on the leaf surface and after a few hours appressoria are formed. The appressoria enable the fungus to penetrate into the host epidermal cells. Species most commonly associated with Cordana leaf spot of banana include Cordana musae (Zimm.) Höhn. (1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. Johnstonei M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125). Cordana leaf spot has been reported mainly on M. sapientum L. but also can be found on M. schizocarpa (Höhn. 1923: 60) and C. johnstonii M.B. Ellis (1971: 125).

The asexual genus Cordana was erected by Preuss (1851) with C. pauciseptata Preuss (1851: 129) as type species. Species of Cordana are characterized by brown, septate conidiophores with swollen conidiogenous zones, terminal and intercalary conidiogenous cells, and pale brown to brown, 0–1-septate conidia. Ecologically, Cordana species can be separated into two groups, namely phanerogam leaf-inhabiting species (saprobic or pathogenic) or saprobic on rotten...
clade in the family Cordanaceae, as the sister clade of Coniochaetales in Sordariomycetes. Cordanales is here erected for the single family Cordanaceae. On the other hand, Neocordana is introduced to accommodate phytopathogenic species similar to Cordana but closely related to Pyriculariaceae (Magnaporthales) rather than Cordanaceae. The family Pyriculariaceae was recently introduced by Klaubauf et al. (2014) and includes important plant pathogens along with Deightoniella S. Hughes (1952: 48) and several pyricularia-like genera. Deightoniella can be easily differentiated from Neocordana since it produces conidiophores reduced to conidiogenous cells with a flattened scar, and conidia with a central pore in the base (Hughes 1952, Klaubauf et al. 2014), while Neocordana has septate conidiophores with denticulate conidiogenous cells and conidia with a protruding hilum. On the other hand, pyricularia-like fungi and Neocordana are similar in having brown, septate conidiophores with polyblastic, denticulate conidiogenous cells. Nevertheless, pyricularia-like fungi are different from Neocordana in having pyriform to obclavate, 2-septate conidia, and grow on grasses and other plants (Seifert et al. 2011, Klaubauf et al. 2014). Neocordana differs by having broadly ellipsoid, obovoid to pyriform, 1-septate conidia and are pathogenic to species of Musa or Canna.

In the phylogenetic analysis generated here (Figure 1), Neocordana is represented by N. musae and N. musicola. N. musae is designated as the type species of the genus, and N. musicola is introduced as a new species, similar but different from N. musae, based on morphological and molecular data. Unfortunately cultures of N. johnstonii and N. versicolor were not available to include in the phylogenetic analysis. Nevertheless we propose new combinations for N. johnstonii, and N. versicolor, based on morphology, pathogenicity and host association. Further studies are needed to confirm their phylogenetic affinities in Neocordana.

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References

http://dx.doi.org/10.3767/003158508X302212


http://dx.doi.org/10.3114/sim.2009.64.02


http://dx.doi.org/10.3852/13-122


http://dx.doi.org/10.2307/3762068

http://dx.doi.org/10.1093/molbev/mst010


http://dx.doi.org/10.1079/9780851993904.0073


http://dx.doi.org/10.1016/S0953-7562(09)81394-4


http://dx.doi.org/10.1016/j.mycres.2006.12.005


http://dx.doi.org/10.2307/3761589


http://dx.doi.org/10.1093/sysbio/sys029


http://dx.doi.org/10.1080/10635150802429642


http://dx.doi.org/10.1093/molbev/mst197


http://dx.doi.org/10.1016/B978-0-12-372180-8.50042-1


http://dx.doi.org/10.5598/imafungus.2014.05.02.07

Zimmermann, A. (1902) Ueber einige an tropischen kulturepflanzen beobachtete pilze. II. Centralblatt fur Bakteriologie, Parasitenkunde und Infektionskrankheiten II Abteilung. 8: 216–221.