

## ***Quambalaria* Species: Leaf and Shoot Pathogens of Increasing Concern to Eucalypt Plantation Forestry**

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**Abstract** – With the rapid expansion of eucalypt plantation forestry globally, the past decade has seen a sharp rise in the number of reports of *Quambalaria* (previously *Ramularia* and *Sporothrix*) species causing foliage, shoot and stem diseases on eucalypts. The severity of disease, the variety of symptoms and host species infected, as well as the geographical range in which *Quambalaria* species occur, have also increased. DNA sequencing has facilitated accurate diagnosis of the four species (*Q. pitereka*, *Q. eucalypti*, *Q. cyanescens*, and *Q. coyrecup*) associated with diseases. In this review, we attempt to summarize all published data on these species, and to compare them in terms of phylogeny, symptoms caused, host range, and current distribution. Phylogenetically the four species form a monophyletic lineage within the Microstromatales, a basidiomycete order closely related to several other orders of smut fungi (Ustilaginomycetes). *Quambalaria pitereka* is known as a shoot and leaf pathogen of a number of *Corymbia* species and has been reported from New South Wales, Queensland and Western Australia. The first discovery of this pathogen outside of Australia was made in 2006 when young *Corymbia citriodora* were found infected in Guangdong, China. *Quambalaria eucalypti* is the only *Eucalyptus* pathogen in the group that has not been found in Australia. It causes serious leaf and shoot blight of seedlings and hedges on several *Eucalyptus* spp. in South Africa, Brazil and Uruguay. The pathogen causing cankers and death of adult *C. calophylla* trees in Western Australia, has recently been described as *Q. coyrecup* (= '*S. destructor*'). The remaining species, *Q. cyanescens*, has been reported from New South Wales and Western Australia, occurring most often in combination with *Q. pitereka* or *Q. coyrecup* on both *Eucalyptus* and *Corymbia*. A currently inexplicable phenomenon is that *Q. cyanescens* had also frequently been isolated from humans (not as pathogens), soil, air, and as associates of various hardwood-infesting bark beetles, from several Eurasian countries from as far West as the Netherlands to as far east as Syria and Iran. The increasing severity and economic impact of disease outbreaks and the expanding geographic and host ranges of *Quambalaria* species, clearly shows that these pathogens should be seriously considered in eucalypt breeding programmes. For effective control measures to be developed, an appropriate understanding of the general biology, life cycles and infection strategies of these fungi will be required, since virtually nothing is known about these aspects of *Quambalaria* species.

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