

### Quantifying southern pine decline: the role of *Leptographium terebrantis*

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*Pinus taeda* L (loblolly pine), one of the economically important and predominant timber species in the Southeastern United States but suffers from growth decline and mortality. Southern pine decline is one of the disease complexes associated with root-feeding bark beetles and their ophiostomatoid fungal associate after predisposition by environmental stressors. Nonetheless, the role of the bark beetle vectored fungi in southern pine decline remains unresolved among researchers. In contributing to the ongoing debate, a study was designed to evaluate the role of the root pathogen, *Leptographium terebrantis* and quantify the amount of growth decline associated with the pathogen. The study was installed in a 13-year-old loblolly pine plantation at Eufaula, Alabama and dendrometer bands were permanently installed on the trees to measure radial growth on a monthly basis. Artificial inoculations were done using sterilized and *L. terebrantis* colonized toothpicks to simulate the natural feeding habits of bark beetles. Twenty-one months of post inoculation treatment, the pathogen caused a 16.3% reduction in basal area increment and 13% mortality in the high inoculum treatment trees. The results demonstrate that the pathogen, *L. terebrantis* is involved in loblolly pine decline.

### *Ceratocystis* wilt affecting *Eucalyptus* plantations in Riau, Indonesia

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*Ceratocystis* wilt is one of the most important diseases on woody plants worldwide. In Southeast Asia, this fungal disease was able to decimate forest plantations of *Acacia mangium*, making unviable the commercial establishment of this crop in the region. As an alternative to this problem, *Eucalyptus* species have been widely planted in mineral soils. Recently, wilting, die-back, xylem discoloration, epicormic shoots sprouting along the stem and consequently death of eucalyptus trees were observed in clones planted in the province of Riau, Indonesia. Infected plant material was examined in the laboratory and *Ceratocystis* sp. was isolated by carrot baiting method. Inoculation of the fungus into healthy plants with subsequently re-isolation was conducted to fulfill Koch's postulate which successfully confirmed the pathogenicity of *Ceratocystis* on *Eucalyptus*. To understand the economical impact of this disease, an extensive survey was conducted. Three clones were identified as susceptible to *Ceratocystis* wilt. Infections have started either from the roots or by stem wounds possibly caused by boring insects, bark cracking or mechanical damage. Infection levels ranged from 1% to 42%, depending on the area or susceptibility of a given clone. Disease progression studies conducted in two compartments planted with the most susceptible clone showed that the disease incidence has increased in 10 months from 15% to 40%, in average, but still low levels of mortality. To successfully control this disease, susceptible clones were removed from the genetic deployment program and a screening system has been implemented for the selection of resistant clones.

### Occurrence of chlorosis and mortality in *Pinus taeda* trees in Southern Brazil / Ocorrência de clorose e mortalidade em árvores de *Pinus taeda* na região Sul do Brasil

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Desde 2014, uma clorose de acículas vem sendo constatada em árvores adultas de *Pinus taeda*, em localidades da região Sul do Brasil, notadamente no estado de Santa Catarina. Os sintomas começam a serem constatados em plantios com 10 anos de idade, na forma de tufo de acículas cloróticas em ramos e ponteiros e, em situações extremas, mortes de árvores com idades acima de 16 anos. Ações sistemáticas com parcelas de monitoramento e de mitigação foram estabelecidas para caracterização do problema. Exames de árvores doentes revelaram: i) raízes mais grossas com lesões escuras e ii) baixa presença e/ou, ausência de raízes de absorção vivas e de ectomicorrizas ativas. Também, se observou baixa incidência de insetos associados. Isolamentos feitos a partir de amostras de raízes de árvores sintomáticas e de solo revelaram a presença de fungos e oomicetos. Análises preliminares de nutrientes em acículas doentes não constatarem relações de causa e efeito sobre a nutrição das árvores. Sítios com a presença de árvores com clorose ocorrem em sua grande maioria em solos desenvolvidos de rochas eruptivas básicas/intermediárias, mas também sem uma aparente relação de causa e efeito. Assim, a clorose do *Pinus* no Brasil é ainda um problema de caracterização difusa e etiologia desconhecida. Inferências iniciais vislumbram uma interação biótica/abiótica, envolvendo agente patogênico, regime hídrico e química do solo.

### How anthropogenic activities have predisposed a keystone tree species to a native co-evolved pathogen to cause a severe and widespread canker disease

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*Quambalaria coyrecup* is a native pathogen that causes a devastating canker disease in the endemic and keystone tree *Corymbia calophylla* (Marri) in the Southwest of Western Australia. In the last 20 years, the impact and severity of this pathogen has increased substantially throughout the range of marri over thousands of square kilometers. Why is this pathogen that co-evolved with its host now so devastating? To answer this question, we used Manion's 'tree decline spiral' as a template to examine the possible predisposing, inciting and contributing factors that could be linked to increased occurrence and severity of the canker disease. We looked at anthropogenic pressures including fragmentation, pesticides and fertilizer inputs, physical and chemical soil changes, changes in mycorrhizae and other soil microflora, the presence of *Phytophthora* species, and the role of a drying and warming climate on the incidence and severity of the disease. We found anthropogenic pressures to play a key role in the disease syndrome, together with changes in key soil nutrients such as phosphorous, ammonium nitrogen, zinc, sodium, and iron, changes in mycorrhizal communities and richness, pH, overstorey diversity, stand basal area and the presence of *Phytophthora* species with canker incidence and severity. These together with their interactions with the host and pathogen will be discussed in detail.