Diseases Caused by Fungi and Fungus-Like Organisms

Root Collar Rot, a New Lethal Disease on *Tectona grandis* Caused by *Kretzschmaria zonata* in Brazil

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Tectona grandis L.f., known as teak, is one of the most valuable tropical hardwood species that has been extensively planted in tropical zones, covering about 6.8 million hectares (Kollert and Kleine 2017). Recent advances in silvicultural management and use of improved clones have enhanced productivity and wood quality of teak plantations in Brazil. However, the incidence of diseases has increased over time, being a threat to sustainability of commercial teak plantations. Therefore, forest pathology studies have been conducted in Brazil to minimize the risks of losses caused by the diseases on teak, ensuring the expected economic profitability. In a recent disease survey conducted in midwest of Brazil, almost 1,000 teak trees showing typical dieback symptoms with root collar rot were found. The diseased trees showed undersized leaves displaying yellowish to pale brown color, followed by wilt, defoliation, and death. At the base of the trunk, root collar rot was observed, with sloughing and deterioration of the bark, exhibiting flattened and encrusted fungi fruiting bodies of gray to bright white color. Over time, the wood of infected trees develops black zone lines and soft tissue due to both lignin and cellulose decay. The disease begins in the root and spreads to the collar of the tree, causing a collapse in sap flow leading to mortality. To discover the disease cause, samples of infected trees were collected to perform an accurate pathogen identification by polyphasic approach, as well as pathogenicity

test. From isolation in malt extract agar (MEA), one fungus showing white progressing to gray mycelial growth was consistently isolated. Two isolates named GFP131 and GFP132 were characterized. Microscopic examination showed conidia aseptate, hyaline, ovoid to fusiform-ellipsoid shaped, measuring 6 to 8 × 2 to 4 µm; stromata with surface brown to dark brown; perithecia with variable shapes and ostioles papillate; and ascospores aseptate, dark brown, fusiform to ellipsoid, measuring 20 to 37 × 8 to 15 µm, displaying a straight germinal line slightly less than ascospore length. These morphological characteristics were similar to descriptions for the genus *Kretzschmaria* (Rogers and Ju 1998; Stadler et al. 2013). Genomic DNA was extracted from mycelium, and the internal transcribed spacer region of rDNA with primer pair ITS1/ITS4 was sequenced and then deposited under GenBank codes MH481853 and MH481854. A BLASTn search showed >99% identity with *Kretzschmaria zonata* sequence (KY660541). Phylogenetic inference by the maximum likelihood method using Kimura two-parameter model confirmed that the isolates belong to *K. zonata* (Lév.) P.M.D. Martin. A pathogenicity test was established in a greenhouse with controlled conditions of temperature (28 to 30°C) and humidity (80 to 90%). Five plants were inoculated with GFP132 at the collar region with one mycelium disk of approximately 5 mm in diameter each, and the inoculated area was wrapped in plastic film. Disks of MEA culture media were placed on five additional plants as controls. Forty days after inoculation, all of the previously mentioned symptoms were observed for all inoculated plants, whereas control plants showed only scars at the inoculation point. The pathogen was reisolated from all five of the inoculated plants. *K. zonata* has been reported on teak in Nigeria (West 1938) and in Mexico (Cibrian Tovar et al. 2014). However, this is the first report of *K. zonata* on *T. grandis* for Brazil and the first report anywhere to include Koch's postulates, proving the etiology of the disease.

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