Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Erysiphe necator* Causing Powdery Mildew to Rubber Tree (*Hevea brasiliensis*) in Brazil

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The rubber tree (*Hevea brasiliensis* Muell. Arg.) is widely used for latex production, representing an important economic resource for the industry. In December 2019, a plantation located in the municipality of São Manuel, São Paulo State, Brazil (22°46'24.6"S, 48°34'32.0"W) had plants showing whitish mycelial growth of powdery aspect on the abaxial surface of mature leaflets. Microscopic analysis revealed a pathogen with hyaline hyphae, which were septate, branched, and had lobed or multilobed appressoria. Conidiophores ranged from 53.9 to 120.3 µm ($\bar{X}$ = 83.5 µm, n = 100) in length and contained foot cells that were upright or had one or two slight twists, ranging from 14.07 to 51.04 µm ($\bar{X}$ = 28.91 µm, n = 100). Conidia were formed singly (not catenulent), ellipsoid to cylindrical, sometimes presenting some curvatures in the middle portion, resembling an hourglass shape, without fibrosin bodies, and measured 25.7 to 44.3 µm ($\bar{X}$ = 35.8 µm, n = 100) in length and 11.4 to 18.7 µm ($\bar{X}$ = 14.8 µm, n = 100) in width. Germination is of the *Pseudoidium* type, showing a lobed or multilobed terminal conidial appressorium, which resembled the characteristics of the anamorph-typified genus *Pseudoidium* (Braun and Cook 2012), which is now, according to the current International Code of Nomenclature, a heterotypic synonym of *Erysiphe*. The presence of the sexual morph (chasmothecium) was not observed. To confirm pathogenicity, five healthy rubber trees were inoculated with a solution of 2×10^4 conidia/ml (sprinkled until draining) and maintained in a growth chamber, at $20 \pm 2^\circ\text{C}$, 80 to 100% relative humidity, and 12-h artificial photoperiod. For control, another five plants were not inoculated and were maintained under the same

conditions. The first symptoms appeared after 10 days, and after 15 days all inoculated plants exhibited symptoms resembling those observed in the field. To confirm the pathogen identity, DNA extraction was performed from leaves containing lesions with sporulation (from plants both in the field and undergoing the pathogenicity test), using the CTAB protocol (Doyle and Doyle 1987). PCR analysis was conducted with a Fermentas PCR Master Mix 2x kit (Thermo Scientific) and the primer pairs ITS-1/ITS-4 (White et al. 1990) and PM3/TW14 (Mori et al. 2000; Takamatsu and Kano 2001), which amplify the ITS1/5.8S/ITS2 and 28S regions, respectively. All PCR products were bidirectionally sequenced and compared with sequences in the GenBank, using the BLASTn tool (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>). From each primer pair, two sequences were obtained: one from plants infected in the field and one from plants infected in pathogenicity tests. rDNA/ITS sequences (GenBank nos. MT182958 and MT180480) shared 99.35% (609/613 identical bases) and 99.51% (608/611 identical bases) identity, respectively, to the isolate PTM1 of *Erysiphe necator* from *Vitis vinifera* (GenBank MK357386), whereas 28S sequences (GenBank nos. MT182732 and MT182949) shared 97.93% (569/581 identical nucleotides, GenBank LC028996) and 99.28% (823/829 identical nucleotides, GenBank MK357423) identity, respectively, to two isolates of *E. necator*, also infecting *V. vinifera*. To date, only *E. quercicola* was related to powdery mildew in rubber trees (Liyanage et al. 2016); therefore, this is the first report of *E. necator* infecting rubber trees in the world. In Brazil, *E. necator* was found infecting *Anacardium occidentale* (Fonseca et al. 2019) and *Caryocar brasiliensis* (Braun et al. 2017) and is one of the major pathogens of the Vitaceae family (Gadoury et al. 2012). The present report also shows an adaptation of this fungus to new hosts, interestingly so far only in Brazil, which adds further challenges to epidemiological studies.

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