Turnera ulmifolia, a new phytoplasma host species

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Abstract

Turnera ulmifolia L., the yellow alder, is a widely distributed species in Brazil where, besides being an ornamental, it is used as a tea for the treatment of gastric diseases. In plants showing yellowing and witches’ broom symptoms, a phytoplasma was detected by molecular analyses; its characterization by RFLP analyses of 16S rDNA gene allowed preliminary classification of this phytoplasma into the 16SrXIII ribosomal group. This is the first time that a phytoplasma from the 16SrXIII group has been reported in Brazil.

Key words: Brazil, chanana, witches’ broom, yellow alder, phytoplasma.

Introduction

Turnera ulmifolia L. (Turneraceae), the yellow alder, is a perennial, dense, compact shrub native to tropical America. The species is widely distributed in Brazil, where it is popularly known as turnera, chanana and flor-do-guarujá. With showy yellow flowers that blossom year-round, turnera is adopted as an ornamental plant, being used as foundation, border, mass planting and ground cover (Lorenzi, 2008). In Brazilian folk medicine, turnera is also used as a tea for the treatment of diseases related mainly to gastric dysfunction. Research has produced data indicating that the plant extract has a significant antiulcerogenic effect (Gracioso et al., 2002). Plants of T. ulmifolia exhibiting witches’ broom growths (figure 1) and yellowing that are symptoms typically induced by phytoplasmas, have been observed in the state of Rio de Janeiro. The aim of the present work was to verify phytoplasma association with the Turnera ulmifolia witches’ broom disease in Brazil and to molecularly identify detected phytoplasmas.

Materials and methods

Samples from T. ulmifolia exhibiting shoot proliferation and yellowing (figure 1) were collected in the location of Penedo, state of Rio de Janeiro, in 2003. DNA extraction procedure followed that of Montano et al. (2000). Reference phytoplasma strains in periwinkle were employed as control (figure 2) and a strain of erigeron witches’ broom phytoplasmas [16SrVII-B, (Barros et al., 2002)] from naturally infected plant from Brazil was also employed as a positive control. Universal primer pairs P1/P7 (Deng and Hiruki, 1991; Schneider et al., 1995) and R16F2/R2 (Lee et al., 1995) were used to prime amplification of phytoplasma 16S rDNA sequences in nested PCR assays. Further nested PCR assays were carried out with primers F1/B6 (Davis and Lee, 1993; Padovan et al., 1995). RFLP analyses were carried out with TaqI on F1/B6 and R16F2/R2 amplicons and with AluI restriction enzymes (Fermentas, Vilnius, Lithuania) on R16F2/R2 amplicons. Obtained patterns were compared with those of phytoplasma reference strains (Bertaccini et al., 2000) on the same size amplicons. Further amplification for molecular characterization of detected phytoplasmas were carried out using rpF(I)/rp(I)R1A primers to amplify the rplV (rpl22) and rpsC (rps3) genes; obtained amplicons were subjected to RFLP analyses with TruI under described conditions (Martini et al., 2007).

Results

Phytoplasmas were detected in turnera plants exhibiting symptoms of witches’ broom disease in direct, as well as in nested PCR tests. RFLP analyses with AluI, TaqI and TruI restriction enzymes on P1/P7, F1/B6 and on R16F2/R2 amplicons (figure 2 and Lee et al., 1998) allowed the tentative phytoplasma affiliation to ribosomal subgroup 16SrXIII. The amplification of the rpl22-rps3 gene resulted in the expected 1.2 kb amplicons and the RFLP profile obtained after TruI digestion was clearly different from any of those available in the literature for the same gene.


Figure 2. RFLP profiles with TruI of the three types of amplicons produced (top left) and with AulI (top right) and TaqI (bottom) of R16F2/R2 amplicons. Acronyms: ErB8, erigeron witches’ broom; TuF5, turnera; GLAWC, 16SrI-B; WBDL 16SrII-B; LN1, 16SrIII-B; BF, 16SrIII-A; EY, 16SrV-A; CPS, 16SrVI-C; ASHY3, 16SrVII-A; AT, 16SrX-A; LNp, 16SrX-B; CH1, 16SrXII; P, marker ΦX174 HaeIII digested.

Discussion

The PCR/RFLP results demonstrate that a phytoplasma is associated with Turnera ulmifolia and this is the first report of phytoplasma infection in the family Turneraceae family. The RFLP profiles obtained are referable to subgroup 16SrXIII (Lee et al., 1998) for which rp gene profiles are not available in literature, further characterization of the phytoplasma is in progress.

In Brazil, the diseases associated with phytoplasmas have been reported in a wide range of families (Montano et al., 2007), however 16SrXIII group phytoplasmas were not reported, although phytoplasmas genetically related with this group (98% homology on 16S rDNA) are listed in GenBank as associated with a papaya apical curl necrosis disease (EU719111).

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References


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