Secondary metabolites produced in two *Piper nigrum* (black pepper) cultivars by *Fusarium solani f.* sp. *piperis* infection.

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Abstract

The chemical profile of *Piper nigrum* cultivars showed different variations during infection by *F. solani* f. sp. *piperis.*

Introduction

The state of Pará is the third world producer of black pepper (*Piper nigrum* L.) and in recent years has faced great loss of culture due to the occurrence of fusariosis, a disease caused by the fungus *Fusarium solani* f. sp. *piperis*[1]. In the literature, the cultivars of *P. nigrum* Bragantina and Cingapura have been described as susceptible and tolerant to fusariosis, respectively[2]. In this study, the roots of both cultivars were infected with *F. solani* f. sp. *piperis* spores and the metabolic profiles roots were monitored by 45 days post infection (dpi).

The essential oils (EO) of leafs were obtained by hydrodistilation (Likens-Nickerson, 2h) and the extracts of roots and leafs were obtained by percolation in ethyl acetate (48h). Techniques of CG-MS and HPLC-UV-MS were used to characterize the chemical profiles. In addition, the phenolic content was determined by Folin Ciocalteu method.

Results and Discussion

The visual progression of the host-pathogen interaction was monitored at 7, 15, 21, 30 and 45 dpi. The first symptoms of disease were observed at 21 dpi, in which the leaves turned yellow in susceptible cultivar Bragantina (Fig. 1). Cingapura cultivar did not show symptoms. The cv. Bragantina EO was rich in oxygenated sesquiterpenes as α-bisabolol (51.4%) and elemol (19.0%) and cv. Cingapura showed high concentrations of sesquiterpene hydrocarbons, as δ-elemene (45.9%). At 21 dpi, infected plants of 'Bragantina' produced 3E-hexenol (0.6%) and showed a decrease in elemol concentration (28.4-15.3%) and increase of α-bisabolol production (51.4-64.3%). For Cingapura cultivar, the production of 13 sesquiterpenes was observed and a decrease in concentration of δ-elemene (55.1 – 44.8%). Furthermore, in both cultivars were detected compounds derivatives from LOX pathway as 3*E*-hexenol and monoterpenes related with defense mechanism as *E*-β-ocimene.

Figure 1. Symptoms of seedlings of *P. nigrum* at 21 dpi by *Fusarium solani* f. sp. *piperis*. (BI21 ⁄ BNI21): cv. Bragantina infected ⁄ non-infected. (CI21 ⁄ CNI21: cv. Cingapura infected ⁄ non-infected.

Infected plants activate signal transduction cascades mediated by plant hormones, which lead to higher expression of genes related to defense[3]. The phenolic content in leafs showed increase only in Cingapura at 7 dpi. However, the roots were most susceptible: Bragantina showed increase at 45 dpi and Cingapura at 15 and 45 dpi. At 21 dpi, Cingapura displayed a significant decrease. The qualitative analysis of roots extracts resulted in the identification of alkamides such as piperine, pellitorina and pipiaqubine in both cultivars.

Conclusion

Many differences were observed in chemical profile between *P. nigrum* cultivars. This metabolomics study can contribute to the genetic improvement and identification markers to resistance in *P. nigrum* cultivars.

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