CONGRESSO LATINO-AMERICANO DE CROMATOGRAFIA E TÉCNICAS RELACIONADAS

Campos do Jordão, Brasil

28-31, Outubro 2025

COLACRO XX (2025)

LIVRO DE RESUMOS

BOOK OF ABSTRACTS

CONSTITUTIVE AND INDUCIBLE CHEMICAL DEFENSES IN RESISTANT MELON LEAVES AGAINST THE LEAFMINER FLY (Liriomyza sativae Blanchard)

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The leafminer fly (Liriomyza sativae) is a major pest of melon crops in Brazil, reducing fruit quality and increasing production costs. Because chemical control has limited effectiveness and can lead to insecticide resistance, developing resistant cultivars is a more sustainable approach. The metabolomic comparison between nearly isogenic lines, 56R (resistant) and 56S (susceptible), offers a precise method to study both constitutive and induced chemical defenses. The genotypes were evaluated at T0 (before infestation) and T2 (three days after infestation and mine appearance) using volatile analysis (SPME-GC-MS), semi-volatile analysis (GC-MS of derivatized extracts from the apolar fraction), and UHPLC-QTOF profiling of secondary metabolites. Volatile profiling showed that 56R did not have a higher abundance of volatile compounds compared to the genotype 56S at T0, indicating that the resistant genotype does not produce constitutive volatile compounds that repel L. sativae. Therefore, L. sativae is likely not deterred by volatiles from 56R and may even be more attracted to 56S, which exhibited slightly higher overall VOC levels. After infestation (T2), both genotypes showed clear changes in VOC profiles; however, 56R displayed a stronger induction of compounds like hexanal, (E)-2-hexenal, β-cyclocitral, D-limonene, and 4-oxoisophorone—associated with lipoxygenase, monoterpene, and carotenoid pathways involved in deterrence and indirect defense. Conversely, α-ionone was mainly detected in 56S, possibly acting as a susceptibility cue. Semi-volatile profiling revealed increased levels of long-chain fatty acids (hexadecanoic, octadecanoic, and linolenic acids) in 56R at T0, suggesting a thicker or more organized epicuticular wax layer likely responsible for antixenosis. Elevated levels of stigmasterols and tocopherols further supported this structural and antioxidant reinforcement. At T2, no consistent pattern was observed, reflecting metabolic adjustments following herbivory. Finally, UHPLC-QTOF analysis in positive ion mode demonstrated that 56R accumulated higher levels of cucurbitacins and other triterpenoids with known antifeedant activity, highlighting these compounds as strong biochemical markers of resistance to L. sativae.

Acknowledgements: Acknowledgments: INCT-ALIM (CNPQ) and Embrapa Agroindústria Tropical