

Imaging Mass Spectrometry as an Innovative Tool to Study Coffee Fruit Development

L. P. SILVA, F. VINECKY, E. A. BARBOSA, A. C. ANDRADE, C. BLOCH JR

Embrapa Recursos Genéticos e Biotecnologia, NT-Bio, CP 02372,
70770-900 Brasília-DF, Brazil

SUMMARY

The coffee fruit development covering the time between anthesis and full ripening is variable from few weeks to more than a year. *Cofea arabica* requires 6 to 8 months to mature. Due to several flowerings that may occur in *C. arabica* at each production season, fruit growth is asynchronous during development, with different proportions of various fruit-developmental stages in the same plant, which may affect cup quality. Except for the large number of studies concerning caffeine metabolism in coffee, very few data are available concerning proteins and metabolic pathways important for coffee cup quality. Therefore, studies on protein expression associated with tissue localization may hold the key to a better understanding of the role of molecules during coffee fruit development. Molecular ion-images acquisition by mass spectrometric methods has opened a novel frontier on detection of molecules on tissue samples. This so called imaging mass spectrometry has been successfully used to perform direct spatial mapping of peptides and proteins in several tissue samples. In the present study, we show the spatial mapping of molecules during several developmental stages of coffee fruits. The *C. arabica* embryos were collected and stored in liquid nitrogen following dissection. After such procedures the embryos were immediately immersed on 1 μ L of matrix (alpha-cyano-4-hydroxy-cinnamic acid, 10 mg/ml in acetonitrile/water/3% trifluoroacetic acid 5:4:1). After 20 min, the embryos were air dried for 10 minutes, mounted onto a target plate by a double-sided adhesive tape, and submitted to mass spectrometric analyses. Ion profiling was performed using an UltraFlex II TOF/TOF (Bruker Daltonic, Germany) operating on positive mode. Automatic scanning steps were accomplished using FlexImaging software. The pulsed laser was rastered across the sample surface in 100 μ m single steps. Spectra were generated for each image from 30 laser shoots at each position in the global maps consisting of 4170 spectra. Intensity-based ion maps of the molecular components of embryos surface were acquired ranging from 2000 to 20000 Da. Despite the presence of several molecular components exhibiting similar spatial distribution profiles during all developmental stages, other components seem to be expressed only on specific stages or specific regions of the evaluated tissues. These observations coupled to the possible spatial co-localization of molecular components could be used as starting points for functional studies aiming at the elucidation of important metabolic steps of coffee fruit development.