PSE E-CONGRESS 2020
PLANT DERIVED NATURAL PRODUCTS AS PHARMACOLOGICAL AND NUTRACEUTICAL TOOLS

Spectroscopic methods in maize (*Zea mays*) metabolome research

Katarzyna Susniak[1], Mikolaj Krysa[2], Iwona Komaniecka[1], Janusz Podlesny[3], Michał Tomczyk[4], Anna Sroka-Bartnicka[1,2*]

[1] Department of Genetics and Microbiology, Institute of Microbiology and Biotechnology, Maria Curie-Sklodowska University, Akademicka 19, 20-033 Lublin, Poland
[2] Department of Biopharmacy, Medical University of Lublin, Chodzki 4a, 20-093 Lublin, Poland
[3] Institute of Soil Science and Plant Cultivation, State Research Institute, Czartoryskich 8, 24-100 Puławy, Poland
[4] Department of Pharmacognosy, Faculty of Pharmacy, Medical University of Białystok, ul. Mickiewicza 2a, 15-230 Białystok, Poland

INTRODUCTION

Zea mays is a member of Poaceae family and one of the most important crop considering culture acreage and nutrition. Maize is rich in large compounds such as proteins (10%), oils (4%), starch (72%) as well as metabolites including carotenoids, flavonoids, variety of organic acids and fibers. Maize supplies also B vitamins and major minerals.

In our study we perform thorough analysis of metabolites present in maize tissues using advanced spectroscopic techniques such as matrix assisted laser desorption/ionization mass spectrometry imaging (MALDI MSI) and Fourier-transform infrared spectroscopy (FT-IR).

SPECTROSCOPIC ANALYSYS

Maize stems, collected from plants after seed coating or foliar spraying with biofertilizer, were cut on the cryomicrotome at -20°C (Leica Biosystems, USA) on 20µm slices and located on glass (for MALDI MSI) and aluminum coated (for FT-IR) slides.

Stems were analyzed with MALDI mass spectrometry imaging (Synapt G2-S*i*, Waters, Milford, USA) and FT-IR spectrometer (Thermo Scientific, Waltham, MA, USA).

The MS settings: negative ion mode, mass range 100-1500 *m/z*; laser 300eV, 1000Hz, step size 60µm x 60µm (x,y axis).

Images were obtained using HDImaging software. Generated maps were normalized to the total ion count.

The FT-IR settings: spectra range 4000-900 cm^{-1}, spectra resolution 8cm^{-1}.

The images were analysed using Cytospec software.

RESULTS

MALDI MSI analysis showed spatial distribution of flavonoids (rutin 609.1 *m/z*, maysin 575.1 *m/z*, quercetine 301.07 *m/z*) and hexose disaccharide (341.1 *m/z*) in the whole stem section. Phosphatidylglycerol (745.5 *m/z*) is concentrated on the edges of the section. Concentration of these compounds differs and is higher after seed coating.

FT-IR analyses showed high concentrations of carbohydrates, free and hydrogen bonded phospholipids and phenolic acids in the examined sections.

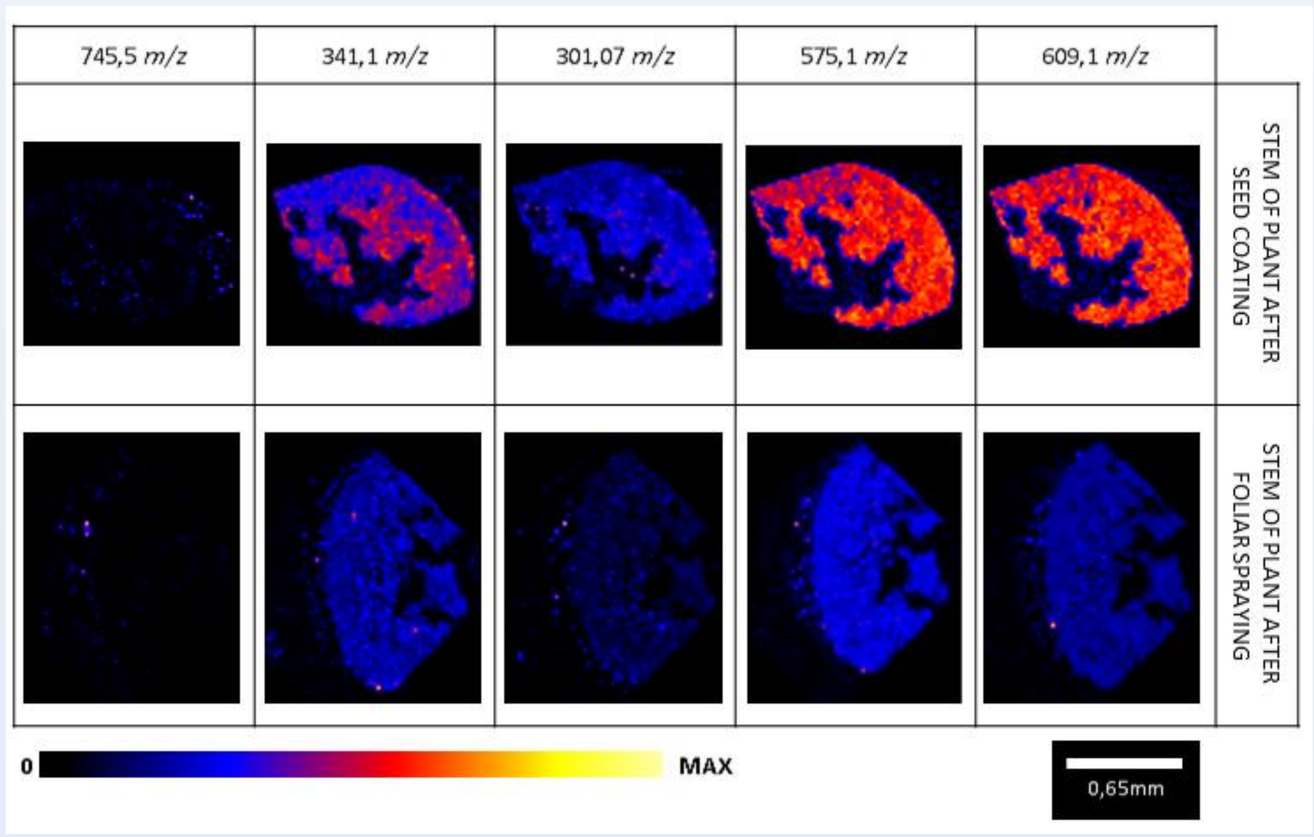

Fig. 1. MALDI MSI images. Chemical maps of selected metabolites in a maize stem cross section: phosphatidylglycerol (745.5 *m/z*), hexose disaccharide (341.1 *m/z*), quercetin (301.07 *m/z*), maysin, (575.1 *m/z*), rutin (609.1 *m/z*).

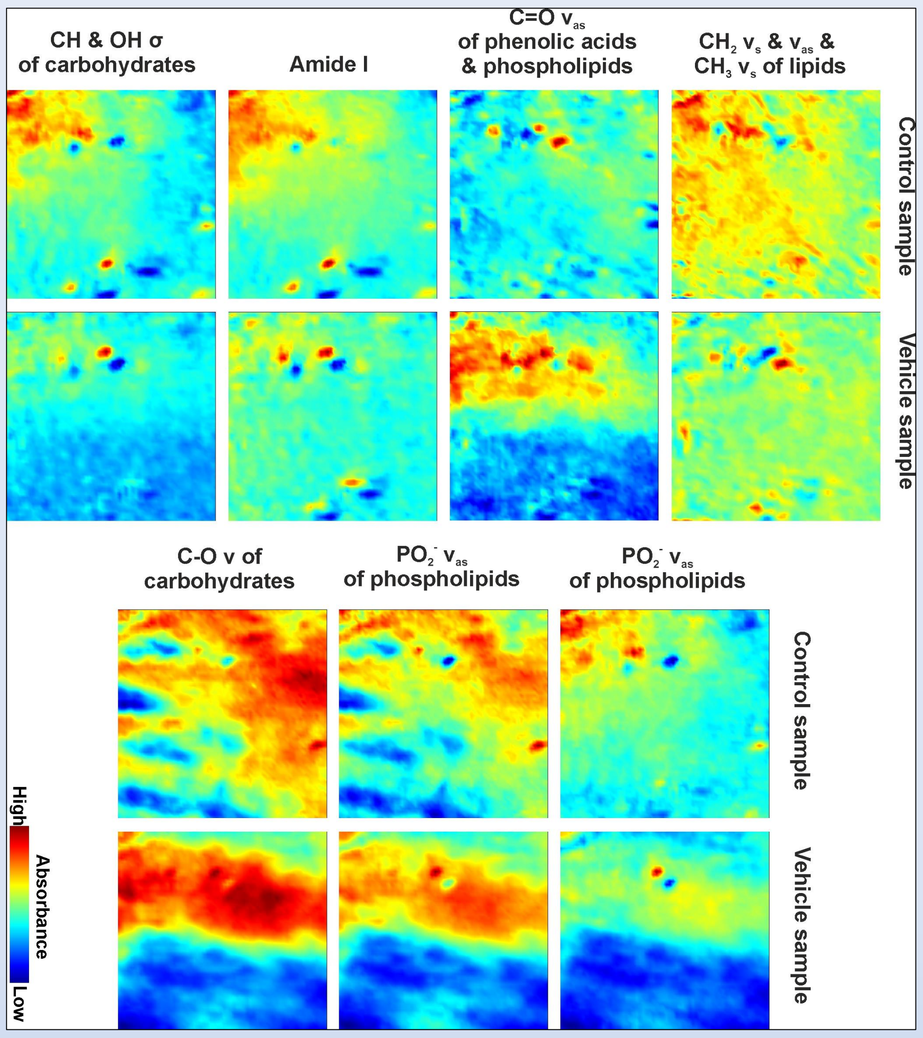

Fig. 2. FT-IR chemical maps presenting the distribution of the selected bands in the maize stem tissue.

CONCLUSIONS

Spectroscopic methods are sufficient in detection and visualisation of spatial distribution of primary and secondary metabolites in plant tissue. Seed coating is less stressful condition for plant than foliar spraying.

This work was supported by National Centre for Research and Development within the Lider VIII programme LIDER/11/0070/L-8/16/NCBR/2017.