Poster

Innovative X-ray fluorescence approaches for the study of plant viroses: the case of flowering ash in the city of Hamburg

Porfido C.[1], Köpke K.[2], Allegretta I.[1], Cesco S.[3,4], Mimmo T.[3], Bandte M.[2], Eschenbach A.[5], Rybak M.[5], Büttner C.[2], Terzano R.[1]

[1]Department of Soil, Plant and Food Sciences, University of Bari "Aldo Moro", Bari, Italy; [2]Humboldt-Universität zu Berlin, Albrecht Daniel Thaer-Institut für Agrar und Gartenbauwissenschaften, Fachgebiet Phytomedizin, Berlin, Germany; [3]Faculty of Science and Technology, Free University of Bozen, Bolzano, Italy; [4]Competence Centre for Plant Health, Free University of Bozen, Bolzano, Italy; [5]Pflanzenschutzdienst Hamburg, Behörde für Wirtschaft, Verkehr und Innovation, Hamburg, Germany

It is ascertained that the world is experiencing climate change. New and sustainable strategies are therefore needed at a global scale to deal with its effects, such as unprecedented drought and heat periods. In urban environments, so-called "climate change trees" (CCT) are being introduced for their expected adaptability to climate change: these are non-native trees, and their suitability for this role must take into account their susceptibility to diseases in the new hosting environment.

This study focuses on a two years sampling (2019-20) of leaves of flowering ash (*Fraxinus ornus* L.), recently planted as CCT in the city of Hamburg (D), many of which (about 20%) showing the typical symptoms of ash shoestring-associated virus (ASaV), i.e. leaf deformation, shoestrings and spotting.

A combined X-ray fluorescence approach, including laboratory and synchrotron micro X-ray fluorescence (μXRF, SR μXRF) and portable energy-dispersive X-ray fluorescence (P-EDXRF) was used to investigate and compare nutrients distribution in leaves of healthy and ASaV infected trees, with the final aim of identifying the physiological processes causing the observed symptoms and possible element markers for a early identification of the virus.

μXRF revealed important differences between infected and healthy leaves, the former showing a rather inhomogeneous element distribution and regions of the lamina with severe depletions of P, S, and Ca. Differently, K concentration appeared higher in infected samples. SR μXRF allowed appreciating variations also in some micronutrients distribution: Mn was more intense in the lamina of the infected leaf while Zn decreased. Besides, the detailed analysis of μXRF spectra revealed that while in healthy leaves Ca is always more abundant than K, this trend is reversed in ASaV samples. Starting from such evidence, K and Ca concentration in ~ 60 leaf samples was quantified via P-EDXRF, generally confirming the higher K/Ca ratio in infected leaves. These results are going to be implemented with a third year (2021) sampling.

If the correlation between the ASaV infection and the K and Ca relative abundances will be confirmed, it could be used, together with visual symptoms appreciation, for indirect pathogen detection by mobile measuring devices, e.g. P-EDXRF. Moreover, element distribution information obtained through the presented X-ray based approach could also provide the basis for developing appropriate strategies to counteract the virus infection.