



Contribution ID: 98

Type: Poster

Synchrotron X-ray Fluorescence (SXRF) Microscopy signifies the role of the micronutrient copper in the reproduction of Cu-deficient *Arabidopsis thaliana* mutants (*spl7*, *citf1*, and *spl7 citf1*) and wild type.

Wednesday, July 12, 2023 4:30 PM (1 hour)

It has been known for decades that the micronutrient copper is essential for plant growth, development, fertility, and seed/grain yield. However, which plant reproductive organs require copper, how copper is delivered to these structures, and how it acts to ensure fertility is not entirely understood. I will report our recent studies deriving from the use of synchrotron x-ray fluorescence microscopy (2D-SXRF) at the nanoscale, 3D and 2D confocal synchrotron x-ray fluorescence microscopy (2D and 3D C-SXRF) and 3D-SXRF-Computed Tomography that allowed us to establish the spatial distribution of copper in floral organs of a model plant *Arabidopsis thaliana* at different resolution scales. I will also discuss the role of two transcription factors in controlling copper uptake, internal transport, and delivery to the specific sites in flowers and the impact of these transcription factors on the development of the male and female gametophytes. Importantly, we show that the role of copper and these transcription factors in reproductive processes is conserved in other plant species. Our new data not only significantly increase our understanding of the role of copper in plant reproduction but also invoke the possibility of its signaling role in reproductive organ development.

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Session Classification: Poster Session 1

Track Classification: Fundamental Research and In Vivo Studies