Contribution ID : **191** Type : **Oral**

"Wax On – Wax Off" Using Infrared Reflectance for minimally invasive in vivo monitoring of changes in leaf epicuticular waxes

Friday, 20 November 2020 11:30 (20)

With increasing global populations and rising temperatures associated with climate change it is important to monitor and mitigate the effects of environmental stress on both native flora and agricultural crops. Epicuticular waxes on the surface of plant leaves play essential roles in sustaining plant health. Such roles include; minimising water loss, protection against UV and diseases, as well as acting as an antifeedent. Studying the composition and distribution of epicuticular waxes on the surface of plant leaves can therefore, provide a valuable window-of-insight into plant fitness and the presence of environmental stressors.

Current methods to study plant waxes require extraction of the wax from the leaf surface. This approach reveals substantial insight into chemical composition of plant waxes but, destroys valuable information relating to the spatial distribution of waxes on the leaf surface. Few methods exist that are capable of imaging the wax distribution in situ across anatomical components of the leaf surface, and a gap exists for non-destructive macro-scale imaging in vivo. In this presentation I will describe the development of FTIR micro-spectroscopy to non-destructively image in vivo wax distribution across the leaf surface of native flora and an important agriculture crop (wheat). The method is underpinned by apparent strong specular reflection that comes from the thin, highly ordered wax layers on leaf surfaces. To the best of our knowledge, this is the first report of in vivo monitoring of changes in leaf epicuticular waxes in response to environmental stressors. This new analytical capability could now enable in vivo studies of plants to provide insights into physiological responses of plants to environmental stresses such as disease, soil contamination, drought, soil acidity and/or climate change.

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Session Classification : Session 12 - Earth, Atmosphere and Environment

Track Classification : Earth, Atmosphere and Environment