ENVIRONMENTAL DRIVERS SHAPING PHYSIOLOGICAL FLEXIBILITY OF PLANTS IN SALINE HABITATS FROM SHARK BAY, WESTERN AUSTRALIA.

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The rapid desertification and salinization of arable soil makes it crucial to better understand adaptation mechanisms of plants in a continuously changing environment. Salinity and drought constitute selective forces in the adjustment of physiological processes in plants and are the major environmental factors determining plant productivity and distribution. Photosynthesis, the essential physiological process in all green plants, is severely affected by heat and salt stress (e.g. Ashaf and Harris, 2013). However, some plants possess flexibility in their C3 and C4 photosynthetic carbon fixation pathway and this increases their tolerance to elevated ambient salinity and temperature (Sage, 2004; Sage et al., 2012; Christin et al., 2013). Birridas, ancient landlocked saline lakes, distributed over Shark Bay of WA offer a unique model to test the influence of ambient salinity stress on plants. Across the Birridas there exists a soil salinity gradient and it is well known that salt-tolerant plant species that grow along stress gradients form characteristic zonation patterns. Furthermore, besides the high salinity, plants growing in the Birridas experience re-occurring anoxic stress resulting from the repeated flooding events. These environmental stresses act as filters shaping ecological and evolutionary adaptation of plants. Biotic interactions, notably with the root-associated microbiome (eukaryotes, bacteria and archaea) also may play an important role in the plant fitness and community assembly.

The overall objective of this project is to investigate salt tolerant plants (halophytes) that grow along salinity gradients in Birridas to improve our understanding of the physiological adaptation mechanism of plants to stress. In particular we will attempt to understand the impact of salinity on the carbon and hydrogen utilization mechanisms of salt-tolerant plants. Compound specific stable carbon isotope analyses are conducted on plant lipids to elucidate the carbon fixation pathways of plants growing under elevated salinities. A preliminary stable carbon isotope analysis on some halophytes from the Shark Bay area suggests the ability to switch between C3 and C4 carbon assimilation pathways. Furthermore we investigate the impact of salinity on the lipid distribution of salt-tolerant plants. Analyses of plant leaf waxes revealed a species-specific n-alkane pattern along soil salinity gradients. Hydrogen isotopic ratios (δD) of leaf waxes will be investigated to explain to what extent the isotopic signal is driven by environmental factors and/or by plant species-specific fractionation. Rhizosphere microbiomes may also play a role to shape adaptation of halophytes, and eventually drive patterns of plant community assembly. Soil microbial communities will be examined from plant rhizosphere to see if microbial communities associated with plant roots change along a salinity gradient and have the metabolic potential to support plant growth under stress conditions.


29th International Meeting on Organic Geochemistry (IMOG)
1–6 September 2019, Gothenburg, Sweden