▶ *Keynote presentations*

K-1139 **Molecular approaches to rhizosphere research: identification and characterization of aluminum tolerance genes and their use to improve acid soil tolerance**

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Aluminum (Al) toxicity is a major limiting factor to agriculture on acid soils that make up approximately 30% of the world's total land area and up to 50% of the world's potentially arable lands. A large proportion of the acid soils occur in developing countries in the tropics and subtropics; thus, Al toxicity reduces food security in many parts of the world where it is most tenuous. Because of the agronomic importance of crop Al toxicity, identifying the molecular determinants for Al tolerance has attracted significant interest from a number of laboratories around the world. We are now poised, based on recent discoveries by a number of researchers, to develop the molecular and genetic resources required to address a worldwide agronomic problem that is only exceeded by drought stress with regards to abiotic limitations to crop production.

In this presentation, the molecular approaches that have been used to identify Al tolerance genes in wheat, *Arabidopsis* and sorghum will be discussed. For example, in sorghum, using high-resolution mapping, we identified AltSB as a candidate Al tolerance gene and subsequently verified its role in Al tolerance based on: 1) a strong correlation between Al-inducible AltSB expression and Al-inducible tolerance and root citrate exudation; 2) a member of a gene family involved in the efflux of organic solutes; 3) protein localization to the plasma membrane; and 4) AltSB expression in transgenic *Arabidopsis* resulting in significant increases in Al tolerance and Al-activated root citrate efflux. Sequence analysis of the parental AltSB alleles and the promoter region from selected members of a sorghum diversity panel, combined with determination of AltSB expression, Al tolerance and root citrate exudation indicates that differences in gene expression are a major determinant of differential tolerance in sorghum. Furthermore, a MITE-type transposable element in the AltSB promoter appears to be a highly polymorphic motif in the promoter region and may play a role in the differential Al-inducible expression.

K-1094 **Burkholderia diazotrophic species exhibit mechanisms involved in plant growth promotion, biological control and bioremediation**

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Burkholderia species, particularly those grouped in the *Burkholderia cepacia* complex (Bcc), constitute one of the dominant bacterial groups in the maize rhizosphere. However, Bcc bacteria have been found in high prevalence as opportunistic pathogens in cystic fibrosis patients. This fact has hampered the commercial development of some Bcc strains in biotechnological processes. In contrast, studies performed on the association of *Burkholderia* species, different to the Bcc, with important agricultural plants are limited. For a long time, N_2-fixing ability in *Burkholderia* species was recognized only in B. vietnamiensis, a member of the Bcc. Novel rhizospheric N_2-fixing *Burkholderia* species associated with plants have been described recently, e.g., *B. unamae*, *B. xenovorans*, *B. tropica*, and *B. silvatlantica*. These diazotrophic *Burkholderia* are closely related, but phylogenetically largely distant from the Bcc species. In fact, cblA and esmR genes encoding transmissibility factors identified among clinical strains from the Bcc were not detected in many strains of *B. unamae*, *B. tropica* or *B. silvatlantica*.

Apparently, the N_2-fixing *Burkholderia* have a large capability of association with plants, as they have been isolated from the rhizosphere of maize, sugarcane, sorghum, coffee, and tomato. The widespread association of such N_2-fixing *Burkholderia* with plants could represent new opportunities in biotechnological processes. Although the involved mechanism is unknown, *B. unamae* and *B. tropica* improve the maize plant growth. *B. tropica* exhibit a great mineral phosphate-dissolving capability, and *B. unamae* exhibit high ACC deaminase activity. In fact, the ACC deaminase activity is a common trait among the N_2-fixing *Burkholderia* species. In addition, the siderophores production by the diazotrophic *Burkholderia* could represent an important trait for controlling plant pathogens. In the N_2-fixing *Burkholderia* species is also remarkable the capability for using as carbon sources some environmental pollutants, for example, *B. unamae* is able to use phenol and benzene for its growth. This feature and the capability of *B. unamae* for promoting growth of maize and to colonize the rhizosphere and rhizoplane of plants could be suitable in rhizoremediation. Based on the data described, we considered that N_2-fixing *Burkholderia* consortia could be used for promoting plant growth and increasing crop yields, and concomitantly in bioremediation, and biocontrol of plant pathogens.