Isolation of Phytase-Producing Rhizobacteria from Extreme Environments

Jacquelinne Acuna¹, Stefanie Gabler², Daniel Menezes-Blackburn², Ralf Greiner², Milko Jorquera¹ and Maria De La Luz Mora¹

¹ Center of Plant, Soil Interaction and Natural Resources Biotechnology, Scientific and Biotechnological Bioresource Nucleus, Universidad de La Frontera, Chile
² Department of Food Technology and Bioprocess Engineering, Max Rubner-Institut Federal Research Institute of Nutrition and Food, Germany

Bacterial communities associated with roots (rhizobacteria) carry out functions that are essential to plant nutrition in terrestrial ecosystems. In comparison to ecosystems under normal conditions, microbial communities under extreme environments have often undergone selection for thousands of years. They may thus be specifically adapted to their plant host and the local soil conditions and thereby contribute to the adaptation of their plant hosts to the local environment. Rhizobacteria that inhabit such harsh regions produce enzymes adapted to those environments. The properties of these enzymes may be of high interest for several biotechnological applications. Phytate is one of the most abundant sources of organic phosphorus in Andisols and phytase-producing rhizobacteria have been proposed as potential biofertilizers to improve phosphorus uptake in plants. Although phytase-producing rhizobacteria are commonly isolated from the rhizosphere of pastures and cereal crops, little is known about the ecology and communities associated with rhizosphere of native plants established extreme Chilean environments. The goal of this study was to isolate and characterize phytase-producing rhizobacteria from Chilean extreme environments. We used various culture media supplemented with vitamins (B5, H, Bx, B3 B6 and B1) and different sources of phosphorus (phytate), carbon (glucose, galactose) and nitrogen to isolate a diverse collection of rhizobacteria. Isolation was obtained from different plants from extreme ecosystems (Atacama Desert, Natural hot spring and Patagonia) located all over Chile. Our results showed that the use of different culture media allowed the isolation of a wide variety of bacterial phenotypes, including those with motility, ability to form biofilms, pigmentation and production of endospores. In addition, two groups of phytase-producing rhizobacteria were isolated from natural hot spring environments and Atacama Desert. The strains were identified as member of thermophilic Geobacillus sp and Bacillus sp (natural hot spring) and Enterobacter sp. genera (Atacama Desert). The phytase produced by the afer mentioned strains were identified as intracellular acid phytases. More precisely, the pytases produced by the thermophilic strains were most likely beta propeller phytases (BPP), since their activity was Ca-dependent and a phytase positive signal was obtained in a PCR reaction with the degenerated primers described by Tye et al., (2002). The phytase activity produced by Enterobacter sp. strains, however, was Ca independent. Thus, this phytase is either a histidine acid phytase or a cysteine phytase. This study showed that Chilean ecosystems contains a wide rhizobacterial diversity and highlight our limited knowledge of their ecology, interaction with plants, and their potential as plant growth promoting rhizobacteria based on the production of phytase.

Acknowledgement: FONCECYT project no. 3140620 and CONICYT-DAAD PCCI11 2011

Keywords: Rhizobacteria, phytase, extreme enviroments
20th WORLD CONGRESS OF SOIL SCIENCE

In Commemoration of the 90th Anniversary of the IUSS

Soils Embrace Life and Universe

June 8-13, 2014 Jeju, Korea

www.20wcss.org