Geophysical Research Abstracts
Vol. 15, EGU2013-10298, 2013
EGU General Assembly 2013

Influence of humic substances on plant-microbes interactions in the rhizosphere

Edoardo Puglisi (1), Silvia Pascazio (2), Riccardo Spaccini (3), Carmine Crecchio (2), Marco Trevisan (4), and Alessandro Piccolo (3)

(1) Istituto di Microbiologia, Università Cattolica del Sacro Cuore, Via Emilia Parmense 84, 29100 Piacenza, Italy (edoardo.puglisi@unicatt.it), (2) Dipartimento di Scienze del Suolo della Pianta e degli Alimenti, Università degli Studi di Bari Aldo Moro, Via Amendola 165/A, 70126 Bari, Italy, (3) Dipartimento di Agraria, Università di Napoli Federico II, Via Università 100, 80055 Portici, Italy, (4) Istituto di Chimica Agraria ed Ambientale, Università Cattolica del Sacro Cuore, Via Emilia Parmense 84, 29100 Piacenza, Italy

Humic substances are known to play a wide range of effects on the physiology of plant and microbes. This is of particular relevance in the rhizosphere of terrestrial environments, where the reciprocal interactions between plants roots, soil constituents and microorganisms strongly influence the plants acquisition of nutrients.
Chemical advances are constantly improving our knowledge on humic substances: their supra-molecular architecture, as well as the moltitude of their chemical constituents, many of which are biologically active. An approach for linking the structure of humic substances with their biological activity in the rhizosphere is the use of rhizoboxes, which allow applying a treatment (e.g., an amendment with humic substances) in an upper soil-plant compartment and take measurements in a lower isolated rhizosphere compartment that can be sampled at desired distances from the rhizoplane.
This approach can be adopted to assess the effects of several humic substances, as well as composted materials, on maize plants rhizodeposition of carbon, and in turn on the structure and activity of rhizosphere microbial communities. In order to gain a complete understanding of processes occurring in the complex soil-plant-microorganisms tripartite system, rhizobox experiments can be coupled with bacterial biosensors for the detection and quantification of bioavailable nutrients, chemical analyses of main rhizodeposits constituents, advanced chemical characterizations of humic substances, DNA-fingerprinting of microbial communities, and multivariate statistical approaches to manage the dataset produced and to infer general conclusions.
By such an approach it was found that humic substances are significantly affecting the amount of carbon deposited by plant roots. This induction effect is more evident for substances with more hydrophobic and complex structure, thus supporting the scientific hypothesis of the “microbial loop model”, which assumes that plants feed rhizosphere microorganisms with carbon in order to support their metabolic activity towards organic materials. This hypothesis is further confirmed by changes in the sugar and organic acids composition, as well as in the fingerprinting of microbial communities obtained by DNA-based phylogenetic analyses. Multivariate statistical analyses also allowed the identification of chemical constituents more related to the observed microbial diversity changes, thus giving useful indications for the design of further experiment aimed at understanding the complex interactions occurring between roots and microbes in the rhizosphere.