TU 203

Genotoxicity study on Vicia faba L. grown on natural and spiked contaminated soils

L. Giorgetti, V. Giansoldati, M. Barbafieri

CNR, Pisa, Italy

Contaminant bioavailability and toxicity varies among soil types and may depend on soil properties and on contaminants characteristics. Metals contamination could have different potential risks depending not only on the total content but on their bioavailability. Operationally, metal bioavailability is often evaluated by chemical extractions characterizing different chemical forms. The use of plant bioassay may be an amenable tool to screen the phytotoxicity of contaminated soils by metals.

In this work different soils contaminated by Boron (B) were studied in relation to plant bioavailability and toxicity. B is an essential micronutrient for plants and generally it is absorbed from soil in the form of boric acid. Previous studies demonstrated that both excess or deficiency of B can affect normal plant development.

Natural B polluted soils and artificially B spiked soils, with B total concentrations ranged between 20 and 100 mg/Kg, were tested on Vicia faba L., plant commonly used for detecting the genotoxic effects of environmental pollutants. Artificially contaminated soils showed the highest B bioavailability (about twofold) when compared with the natural polluted soil at similar B total content. Cytological analysis was carried out on root tip meristems of Vicia faba, after 3 days of seed germination in the different B polluted soils; mitotic index and micronucleus assay (MNC) were determined for genotoxicity evaluation. Moreover, developmental and physiological parameters were analyzed during plant growth in the B contaminated soils. The B content in distinct organs of the plants was determined and compared with B content in soil (distinguishing the total from the bioavailable) and with the genotoxicity effects.

The results showed the close relationship between B bioavailability, genotoxicity and B content in the plant. The natural polluted soil and spiked soil with similar B content in the bioavailable fractions showed the same pattern of phytotoxicity and genotoxicity in Vicia faba.

It is interesting to stress that bioavailability of B, and its content in the different plant organs, resulted higher in artificially spiked soils when compared with the same B concentrations in natural soils.

A close correlation between high B concentration in roots and major level of cytogenetic defects was found. These results confirmed plant genotoxicity of B polluted soils and showed clear evidences between soil properties, B bioavailability and phytotoxicity.