Geophysical Research Abstracts,
Vol. 11, EGU2009-8186, 2009
EGU General Assembly 2009

Dissolved Organic Matter (DOM) From Different Composts: Comparative Study Of Properties And Allelochemical Effects On Horticultural Plants

A. Traversa, E. Loffredo, C.E. Gattullo, and N. Senesi

Dipartimento di Biologia e Chimica Agro-forestale e Ambientale, University of Bari, Bari, Italy (loffredo@agr.uniba.it, 0805442850)

Dissolved organic matter (DOM) from compost has a major role in numerous chemical and biological processes occurring in the bulk substrate or compost amended soil, and can exert allelochemical effects on plant germination and growth. The objectives of this study were: (i) to investigate comparatively the main properties of three DOM fractions isolated from a green compost (DOMGC), a mixed compost (DOMMC) and a green coffee compost (DOMGCC), and (ii) to evaluate their allelochemical effects on the germination and early growth of two horticultural plants of worldwide interest such as tomato and lettuce.
The DOM was extracted from each compost with distilled water (1/10 w/v) under mechanical shaking for 15 min. The suspension was then centrifuged at 6000 rpm for 15 min and filtered sequentially through filters with decreasing particle size retention (from 11 to 0.45 μm). Each DOM sample was characterized by means of pH, electrical conductivity, total organic carbon (TOC), E4/E6 ratio, fluorescence and FT IR spectroscopies and HPLC analysis. Comparative evaluation of the three DOM samples indicated the occurrence of significant differences among them. In particular, the pH value was similar and close to neutrality for DOMMC and DOMGC, whereas it resulted alkaline (pH 8.3) for DOMGCC. The EC values were also similar (about 3.2 mS/cm) for DOMMC and DOMGC and almost half value for DOMGCC. The TOC content, the E4/E6 ratio, the 280 value and the humification index followed the same order: DOMGCC>DOMMC>DOMGC. The fluorescence analysis of the three DOM samples showed the presence of a common fluorophore unit associated to simple aromatic units such as phenolic-like, hydroxy-substituted benzoic and cinnamic acid derivatives. The peak wavelengths observed in the fluorescence emission, excitation and synchronous scan spectra of DOMGCC were generally higher than those of the two other DOM samples, which can be ascribed to a more extended aromatic system of the former. The FT IR spectra of all DOM samples indicated the presence of aromatic phenolic structures, while the HPLC chromatograms suggested the presence of benzoic acid derivatives such as phthalic and salicylic acids.
Seed germination and seedling early growth were performed in a Phytotron growth chamber at 23 ± 1 °C. Sets of 10 seeds of tomato and lettuce were separately placed on filter paper in Petri dishes and added with 3 ml of distilled water (control) and each DOM sample diluted in distilled water at ratios of 1:10 and 1:2. After 6 or 4 days, respectively for tomato and lettuce, the number of germinated seed, the length of primary root and shoot, and the fresh and dry weights of seedlings were measured. All experiments were replicated five times, and the data were statistically analyzed by one-way analysis of variance (ANOVA) and the least significant differences test (LSD). The percentage of germinated seeds was not altered by the presence of any DOM sample at the two doses. Conversely, significant allelochemical effects were produced by DOM on seedling early growth, in the order DOMGC > DOMMC > DOMGCC, particularly at the higher dose. The maximum stimulation of tomato growth was exerted by DOMGC at the higher dose with increases of 79 and 68%, respectively, for primary shoot length and seedling fresh weight. In the case of lettuce, these parameters increased to a maximum of 86 and 39% in the treatments with DOMMC and DOMGC, respectively, at the higher dose. Finally, significant correlations were obtained between the allelochemical effects and the DOM properties considered.