Geophysical Research Abstracts
Vol. 15, EGU2013-5170, 2013
EGU General Assembly 2013

Response of dandelion (Taraxacum officinale Web) to heavy metals from mine sites: micromorphology of leaves and roots.

Claudio Bini (2), Laura Maleci (1), Gabriella Buffa (), Mohammad Wahsha (), and Silvia Fontana ()

(2) University of Venice, Environmental Sciences, Venice, Italy (bini@unive.it, +39 412348584), (1) University of Florence, Biology Dept, Florence, Italy (maleci@unifi.it +39 55 2757896), (3) Marine Science Center, University of Jordan, Aqaba section

Response of dandelion (Taraxacum officinale Web) to heavy metals from mine sites: micromorphology of leaves and roots.

Maleci L.1 , Bini C.2, Buffa G. 2, Fontana S2., Wahsha M.3

1 – Dept of Biology, University of Florence, Italy.
2 – Dept of Environmental Sciences, Informatics and Statistics. Ca'Foscari University, Venice – Italy.
3 – Marine Science Centre - University of Jordan, Aqaba section, Jordan.

Heavy metal accumulation is known to produce significant physiological and biochemical responses in vascular plants. Yet, metabolic and physiological responses of plants to heavy metal concentration can be viewed as potentially adaptive changes of the plants during stress.
From this point of view, plants growing on abandoned mine sites are of particular interest, since they are genetically tolerant to high metal concentrations, and can be utilized in soil restoration.
Among wild plants, the common dandelion (Taraxacum officinale Web) has received attention as bioindicator plant, and has been also suggested in remediation projects.
Wild specimens of Taraxacum officinale Web, with their soil clod, were gathered from three sites with different contamination levels by heavy metals (Cd, Cr, Cu, Fe, Pb, Zn) in the abandoned Imperina Valley mine (Northeast Italy). A control plant was also gathered from a not contaminated site nearby. Plants were cultivated in pots for one year at HBF, and appeared macroscopically not affected by toxic signals (reduced growth, leaf necrosis) possibly induced by soil HM concentration. Leaves and roots taken at the same growing season were observed by LM and TEM.
Light microscopy observations carried out on the leaf lamina show a clear difference in the cellular organization of not-contaminated and contaminated samples. The unpolluted samples present a well organized palisade tissue and spongy photosynthetic parenchyma. Samples from contaminated sites, instead, present a palisade parenchyma less organized, and a reduction of leaf thickness proportional to HM concentration. Indeed, at high HM contents, leaf parenchyma is constituted of few roundish cells with large intercellular spaces, while palisade structure is lacking at all.
Comparing the leaf morphology with their metal content, it appears that the poor structural organisation, and the reduced foliar thickness of the contaminated plants, are strictly related to soil contamination.
Similar observations have been recorded on cortex parenchyma of the roots, which presents a reduced thickness in comparison to the control, proportional to HM content in the soil. Moreover, all the samples examined do not present hairs on the root epidermis, but mycorrhizae, which are well developed in the control, and nearly lacking in the contaminated samples.
Preliminary ultrastructure observations of the parenchyma cells of contaminated samples show mitochondrial structure alteration, with lacking or reduced cristae of the internal membrane at increasing metal content, in comparison to the not-contaminated sample. Instead, chloroplast organization does not present significant differences, particularly in number and compartmentalization of thylacoids.
Although macromorphology does not present evidence of phytotoxicity, the recorded observations of the micromorphological characteristics of leaves and roots, show a suffering state strictly related to HM content. However, T. officinale, besides the recorded abnormalities, proved to be able to grow on moderately contaminated soils, and therefore may be utilized to colonize polluted sites.