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Contaminated soils and water pose a major environmental problem. As the industrial methods to remove contamination from polluted areas are cumbersome and expensive, new more cost effective technologies have been attracting increasing attention. Phytoextraction is the use of plants which are able to accumulate toxic elements and therefore to remediate contamination of soils (SALT *et al.* 1998). It suffers from a number of limitations since hyperaccumulators, such as *Thlaspi caerulescens*, are often slowly growing plant species with low biomass production. The aim of our research is to identify interesting plant accumulators which may associate an important biomass production with an effective absorption and translocation of heavy metals to the aerial parts. We focus on *Atriplex halimus*, a perennial halophyte species.

Seeds were collected on a contaminated area in La Peña (Spain). Twenty-one-day old plants were acclimatised on hydroponic culture on a modified Hoagland solution (GULICK & DVOŘÁK 1987). After one week acclimation, heavy metal stress was imposed for three weeks by four different solutions containing a) 0.1 mM ZnSO₄, b) 0.1 mM CdCl₂, c) 0.075 mM CuSO₄, and d) 0.01 mM CuSO₄ + 0.1 mM ZnSO₄.

The Cd treatment weakly affected the shoot dry weight and had no effect on the root dry weight. Cd concentration strongly increased in the roots (up to 15 µmol g⁻¹ Dry Weight) and, to a lesser extent in the stems and the leaves (up to 5 µmol g⁻¹ DW). Both Zn and Zn + Cu treatment induced a significant increase in Zn accumulated in all parts of the plant. Cu was very detrimental to the plant and induced a strong decrease in plant growth although no accumulation of Cu was detected in the aerial part. However, in the presence of Zn (mixed treatment), a significant accumulation of Cu was detected in both roots and shoots.

The present study demonstrates that during a short exposure to heavy metal stress, the halophyte species *Atriplex halimus* is able to accumulate high amounts of both Zn and Cd without any

significant growth inhibition. Although the concentration observed in the present work was lower than concentrations reported for classical hyperaccumulating species such as *Thlaspi caerulescens*, the fact that *Atriplex halimus* has a high potential for biomass production (up to five tons per hectare) leads us to conclude that it may be considered as a promising species for phytoremediation purposes. Further experiments are however needed in order to analyse the behaviour of the plant in response to a long term exposure to zinc and cadmium and to identify the precise physiological properties involved in heavy metal stress tolerance.

References

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Evaluation of the vegetation management in the nature reserves of the Sonian forest, part Brussels capital region

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Vegetation data from 25 permanent plots (1-7 m²) were yearly collected during the growing vegetation season (June and July) from 1995 to 2000 in marshland sites, where conservation and restoration practices (mowing, flooding, fencing) were performed since 1994. Species composition was characterised by classical Braun-Blanquet relevés. For each vegetation sample, a banality

index was calculated based on the intrinsic species rarity as reported for northern Belgium by STIEPERAERE & FRANSEN (1982). A 10-level scale was used, with 1 for a very rare vegetation to 10 for a very common one. These average values were weighted by the species' cover. Since Braun-Blanquet cover-abundance values were not suitable for mathematical treatment, raw data were transformed by taking the median of each scale interval : 87.5, 62.5, 37.5, 15.0, 2.5, 0.5, and 0.2 accounting for 5, 4, 3, 2, 1, + and r, respectively (arbitrary values were taken for r, + and 1). In order to detect a management effect, statistical analysis of the species abundance data was performed using Wilcoxon matched pairs tests (with casewise deletion of missing data).

From the whole data set, mean species richness progressively increased from 9.3 species / plot in 1995 to 14.6 species / plot in 2000. No significant change appeared for the average values of banality index, although a slight trend to a decreasing banality was found (from 6.06 in 1995 to 5.54 in 2000). At the individual species level, cover of some indicator species significantly changed. Competitive ruderal species, like *Urtica dioica* and *Galium aparine*, were affected by management and showed a decline in cover. Some wetland species, such as *Angelica sylvestris*, *Lysimachia vulgaris*, *Lythrum salicaria*, and *Epilobium parviflorum*, increased in abundance. No overall change in cover during the investigated period was found for the following wetland species : *Carex acutiformis*, *Chrysosplenium oppositifolium*, *Equisetum telmateia*, *Glyceria maxima*, *Lycopus europaeus*, *Mentha aquatica*, *Myosotis scorpioides*, *Phragmites australis*, *Scrophularia umbrosa*, *Sparganium erectum*, and *Rumex sanguineus*.

From our preliminary results, we can conclude that nature management practices, such as mowing and flooding, combined with fencing against human pressure, can in a very short period of time (six years) initiate the regeneration of degraded vegetation types. This is detected from the positive evolution of the species richness, the increase in abundance of some wetland species and the decline of competitive ruderal species. Such kind of study can therefore contribute to

give an insight into species response to conservation and restoration practices. It will be used to help drawing up the management plans for the Brussels Natura 2000 areas, in particular the habitat improvement measures urgently required in favour of wetland species. Anyway, we have to bear in mind that short-term and long-term studies can yield different results : species for which the abundance did not seem to be affected by management during the first six years might show a response in the long term. So, further study is necessary to assess the long-term effect of management.

Reference

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Underground biodiversity - check-list commentée des champignons hypogés (Ascomycotina, Basidiomycotina, Zygomycotina et Deuteromycotina) de Belgique et du Grand-Duché de Luxembourg

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Depuis la parution du catalogue des champignons hypogés de Belgique et du Luxembourg (THOEN 1988), le nombre d'espèces reconnues dans la dition est passé de 47 à 65, soient 18 nouvelles espèces, ce qui représente un accroissement d'environ 28%. Une prospection plus intense du territoire, en particulier du district lorrain, et une révision récente du genre *Rhizopogon* (MARTIN 1996) expliquent ce progrès. Au Luxembourg, le nombre d'espèces est passé de 14 (en 1988) à 46 (fin 2001). Les terrains calcaires et argilo-calcaires sont plus riches que les terrains acides, bien que ces derniers hébergent des espèces préférentielles. La plupart des