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Evaluation of three endemic Mediterranean plant species Atriplex halimus, Medicago lupulina and Portulaca oleracea for Phytoremediation of Ni, Pb and Zn

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The success of phytoremediation depends upon the identification of suitable plants species that hyperaccumulate/tolerate heavy metals and produce large amounts of biomass. In this study, three endemic Mediterranean plant species *Atriplex halimus, Medicago lupulina* and *Portulaca oleracea*, were grown hydroponically to assess their potential use in phytoremediation of Ni, Pb and Zn and biomass production. The objective of this research is to improve phytoremediation procedures by searching for a new endemic Mediterranean plant species which can be used for phytoremediation of low/moderate contamination in the Mediterranean arid and semiarid conditions and bioenergy production. The hydroponics experiment was carried out in a growth chamber using half strength Hoagland's solution as control (CTR) and 5 concentrations for Pb and Zn (5, 10, 25, 50 and 100 mg L^{-1}) and 3 concentrations for Ni (1, 2, and 5 mg L^{-1}). Complete randomized design with five replications was adopted. Main growth parameters (shoot and root dry weight, shoot and root length and chlorophyll content) were determined. Shoots and roots were analyzed for their metals contents. Some interesting contributions of this research are: (i) plant metal uptake efficiency ranked as follows: *A. halimus* > *M. lupulina* > *P. oleracea*, whereas heavy metal toxicity ranked as follows: Ni > Zn > Pb, (ii) none of the plant species was identified as hyperaccumulator, (iii) *Atriplex halimus* and *Medicago lupulina* can accumulate Ni, Pb and Zn in their roots, (iv) translocate small fraction to their above ground biomass, and (v) indicate moderate pollution levels of the environment. In addition, as they are a good biomass producer, they can be used in phytostabilisation of marginal lands and their above ground biomass can be used for livestock feeding as well for bioenergy production.