



The first report of Pb and Zn accumulation in some native plants from the Peruvian Andes

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Until recent decades little has been known about the remediation of mining sites using metalophytes in Latin America. Metal mining has helped to create severe and diverse environmental problems. The present study proposed to identify and characterize spontaneously growing heavy metal tolerant plant species in the area around the polymetallic mine in Hualgayoc (Cajamarca, Peru). These species are potentially useful for phytoremediation. Plant and soils from their rhizosphere were sampled and analyzed for concentration of As, Fe, Mn, Pb and Zn. Translocation Factor (TF) defined the metals concentrations ratio between shoots and root biomass and Shoot Accumulation Factor (SAF) the metal concentration ratio between shoot and soil concentration were determined and used to measure the effectiveness of a plant in concentrating metals into its biomass.

The soils were neutral pH (7.4 ± 0.5) with variable content of organic carbon (2.4 ± 1.1) and loam texture: sand (42.9 ± 10.8) and clay (16.7 ± 4.6). According to the total metals, all samples exceeded toxicity thresholds, high Pb ($20016 \pm 32559 \text{ mg} \cdot \text{kg}^{-1}$) and Zn ($22512 \pm 13056 \text{ mg} \cdot \text{kg}^{-1}$) concentrations were detected. High shoot Pb and Zn concentrations were found in Plantaginaceae *Plantago orbignyana* (6998 and 9617 $\mu\text{g/g}$); Brassicaceae *Lepidium bipinnatifidum* (6886 and 5034 $\text{mg} \cdot \text{kg}^{-1}$) and Asteraceae *Senecio* sp (4253 and 3870 $\text{mg} \cdot \text{kg}^{-1}$) and *Baccharis latifolia* (2554 and 1284 $\text{mg} \cdot \text{kg}^{-1}$ respectively). The high values of TFs indicates that the plants effectively translocated metals. *Lepidium bipinnatifidum* shows the highest TFs values (143 in Pb and 21.5 in Zn). The SAF values were much lower than those reported for other species such as *Paspalum* sp in the Peruvian copper mine, which may be due to a high top soil Pb and Zn concentrations.

These species can surely be considered as interesting for phytoextraction, due not only to its accumulative capacity but also since they showed an elevated transfer factor and grew in the presence of other toxic metals. The present study is, to the best of our knowledge, the first report of the metal accumulation ability of these plant species.