

Copper and Cadmium Tolerance, Uptake and Effect on Chloroplast Ultrastructure. Studies on *Salix purpurea* and *Phragmites australis*

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We have compared the effect of toxic Cu and Cd concentrations on growth, metal accumulation, and chloroplast ultrastructure of willow (*Salix purpurea* L.) and reed [*Phragmites australis* (Cav.) Trin. ex Steud.]. After a 10-day treatment, both species have tolerated to some extent the lowest concentration of both metals; however, plant growth was strongly reduced at the highest Cu and Cd concentrations. These plants could be described as Cu-tolerant at the lowest concentration tested, showing a higher tolerance index in reed than in willow; in contrast, willow exhibited higher tolerance against Cd. Both plants appeared to be moderate root accumulators of Cu and Cd. Ultrastructural studies revealed special features that can provide some protection against heavy metals stress, such as ferritin aggregates in the stroma. In addition, Cu and Cd induced distortion of thylakoids, reduction of grana stacks, as well as an increased number and size of plastoglobuli and peripheral vesicles.

Key words: Heavy Metal Toxicity, *Phragmites australis*, *Salix purpurea*