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TRANSCRIPTOMIC ANALYSIS IN RESPONSE TO LONG PERIOD OF CADMIUM EXPOSURE REVEALS TOLERANCE MECHANISMS INVOLVING THE ROOT CELL WALL LIGNIFICATION IN ARUNDO DONAX L.

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The expected increase of sustainable energy demand shifted the attention towards bioenergy crops. Due to their know tolerance against abiotic stress and relatively low nutritional requirements, they have been proposed as election crops to be cultivated in marginal lands without disturbing the part of lands employed for agricultural purposes. *Arundo donax* L. (giant cane) is a promising bioenergy crop whose behaviour under water and salt stress has been recently studied at transcriptomic levels. As the anthropogenic activities produced in the last years have led to worrying increase of cadmium (Cd) contamination worldwide, the aim of our work was to decipher the global transcriptomic response of *A. donax* leaf and root in the perspective of its cultivation in Cd contaminated soil. In our study, RNA-seq libraries yielded a total of 416 million clean reads and 10.4 Gb per sample. *De novo* assembly of clean reads resulted in 378,521 transcripts and 126,668 unigenes with N50 length of 1812 bp and 1555 bp, respectively. Differential gene expression analysis revealed 5,303 deregulated transcripts (3,206 up- and 2,097 down regulated) specifically observed in the Cd-treated roots compared to Cd-treated leaves. Among them, we identified genes related to “Protein biosynthesis”, “Phytohormone action”, “Nutrient uptake”, “Cell wall organisation”, “Polyamine metabolism”, “Reactive oxygen species metabolism” and “Ion membrane transport”. Globally, our results indicate that ethylene biosynthesis and the downstream signal cascade are strongly induced by Cd stress. In accordance to ethylene role in the interaction with the ROS scavenging machinery, the transcription of several genes devoted to cope the oxidative stress (NADPH oxidase 1, superoxide dismutase, ascorbate peroxidase, different

glutathione S-transferases and catalase) is strongly activated. Moreover, data indicate an up-regulation of genes encoding several small signal peptides belonging to *ROTUNDIFOLIA*, *CLAVATA3*, and C-TERMINALLY ENCODED PEPTIDE 1 (CEP) in Cd-treated roots normally functioning as messenger molecules from root to shoot in order to communicate the stressful status to the upper part of the plants. Finally, the main finding of our work is that genes involved in cell wall remodelling and lignification are decisively over-expressed in roots, probably to create a physical barrier against Cd ions. This result is also confirmed by low Cd content, both in the aboveground and belowground parts of the plant, which indicates very low Cd uptake occurred. Thereby, the cell wall lignification might represent an adaptative mechanism to avoid the entry of Cd into the cell in giant cane.