Geophysical Research Abstracts
Vol. 20, EGU2018-5177-1, 2018
EGU General Assembly 2018

Physiological response of Cistus salviifolius L. originated in mine areas to growth in hydroponic systems at high arsenic concentrations

Luísa C. Carvalho (1), Cláudia Vieira (2), Maria Manuela Abreu (3), and Maria Clara F. Magalhães (4)

(1) Universidade de Lisboa, Instituto Superior de Agronomia, Linking Landscape, Environment, Agriculture and Food Research Centre (LEAF), Lisboa, Portugal (lcarvalho@isa.ulisboa.pt), (2) Instituto Superior de Agronomia, Universidade de Lisboa, Lisboa, Portugal (clauffv@gmail.com), (3) Universidade de Lisboa, Instituto Superior de Agronomia, Linking Landscape, Environment, Agriculture and Food Research Centre (LEAF), Lisboa, Portugal (manuelaabreu@isa.ulisboa.pt), (4) Departamento de Química and CICECO-Aveiro Institute of Materials, Universidade de Aveiro, 3810-193 Aveiro, Portugal (mclara@ua.pt)

High concentrations of arsenic are common in mine areas of the Iberian Pyrite Belt and pose a serious threat to the environment in that region. Therefore, it is extremely important to understand which plant species are able to withstand those conditions so that they are able to colonize and stabilize those heavily contaminated soils/spoils. Cistus salviifolius is an autochthonous species in the area and has been described as growing well under extreme conditions. To better understand how this species copes with high contamination levels of potentially hazardous elements, the physiological response of C. salviifolius to oxidative stress induced by As was evaluated in an hydroponic system for 30 days at concentrations of 0, 500, 1500, 5000, 20000 and 30000 μg As/L.
Several growth parameters, chlorophyll content, chemical composition, one indicator of oxidative stress (H_2O_2) and two of the major anti-oxidative metabolites, ascorbate (AsA and DAsA) and glutathione (GSH and GSSG) were analyzed.
The toxic effect of As was more forceful in the plants submitted to treatments with the highest As concentrations (20000 and 30000 μg/L). Plants subjected to these treatments had higher concentration of As in roots and shoots. Arsenic concentrations in shoots increased linearly with the As concentration in the treatments, reaching values which can be considered phytotoxic (between 0.005–0.02 g/kg leaf fresh weight). The concentrations of Ca, Mg, K and Fe in the plants, as well as a large part of the evaluated growth parameters were also affected. Oxidative stress, in the form of H_2O_2 concentration, was higher in roots and increased with As concentration. However, globally, As did not interfere in the photosynthetic capacity of the plant, because there were no significant differences in the contents of chlorophyll a, b and total between the different treatments. Plants from all treatments accumulated higher amount of As in roots than in shoots, and it was also in the roots that the concentrations of H_2O_2, AsA and GSH were higher. Cistus salviifolius showed high tolerance to As up to the concentration of 5000 μg/L. Above that concentration, in the treatments subjected to 20000 and 30000 μg As/L the high As concentrations in leaves were so high that ROS removing mechanisms were not enough to counter the oxidative stress caused by those high As levels. As a result, those plants started showing visual symptoms of toxicity, such as leaf necrosis and tissue death. These results make Cistus salviifolius a species with high potential to be used in the phytostabilization of soils contaminated with As at medium to moderately high levels in the available fraction, such as abandoned mining sites.